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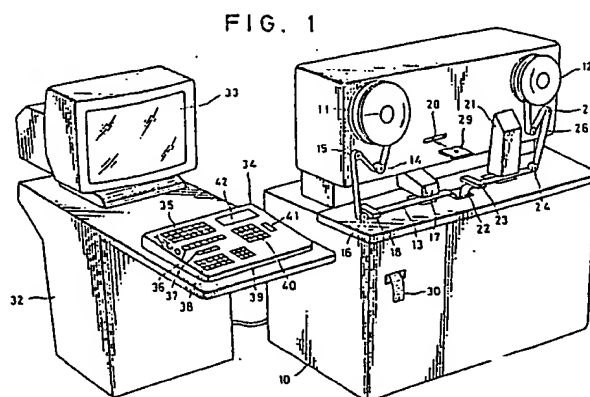
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⑤4 Color film analyzing method and apparatus therefore.

⑤7 A color film analysing method and apparatus which displays the image data as positive images provided by a TV camera and a plurality of reference images previously provided and stored in a recording member, in a matrix pattern on an image display device. When specifying one of the color images of the picture frames, the image line of the matrix including the specified image is shifted adjacent to the reference image line on the image display device and a cursor image is displaced overlapping the specified image. The cursor image is provided as a reversed image of the part of the specified image where the specified image is inlaid with the cursor image. If the reversed image has a color identical or similar to that of part of the specified image surrounding the cursor image, the cursor image is colored differently. Any images, when specified, is magnified and displayed at the center of the image display device.



Description

COLOR FILM ANALYZING METHOD AND APPARATUS THEREFORE

Background of the Invention

The present invention relates to a method and apparatus used for analysing or inspecting color films.

Video type color film analyzers are well known in the art. One example disclosed in Japanese Unexamined Patent Publication No.62 - 141,530 has a color TV camera for providing color image data of picture frames of a number of rolls of color films spliced one another. The color image data of the respective picture frames are stored in a memory. The color image data of each picture frame read out from the memory is, after having been transformed in gradation based on its large area transmittance density (LATD) and transformed from negative form to positive form, sent to one of a plurality of CRT displays arranged in a line to display a simulated color image thereon. Color film analyzer of this type can display a plurality of color images, simulated and to be simulated, on the CRT displays in a line. The center CRT display displays a color image under inspection and/or correction and the remaining CRT displays, in particular on one side of the center CRT display, color images inspected and corrected if needed and, on the opposite side of the center display, color images to be inspected. Therefore, the simulated color image on the center CRT display can be estimated comparing with adjacent corrected and uncorrected color images.

In another color film analyzer of this type disclosed in, for example, U.S. Patent Nos. 4,364,084 and 4,531,150, the color images simulated or to be simulated are displayed in a matrix pattern. Any one of the displayed color images, if undesirable in color and/or density as a printed image, is specified with such as a light pen to correct exposure. Image data of the specified image is transformed in gradation according to the corrected exposure so that the color image is correctly changed in color and/or density.

The image data of picture frames to be displayed are written in and read out from an image memory as is disclosed in, for example, European Unexamined Patent Publication No. 108,158.

Such video type color film analyzers are associated with various drawbacks. Because a roll of color film often includes frames bearing unintended principal subject images, blurred images or the like which usually need not be printed. The color film analyzers heretofore used are hard to specify an image or images which are unnecessary to print from visual inspection. It is therefore often to repeatedly specify picture frames having no necessity of print.

It is also difficult to determine whether each simulated image is proper in color balance and/or density.

In the above examples, although a plurality of simulated images or images to be simulated are displayed on a single display device such as a CRT

and therefore inspected efficiently, each image is, on the contrary, too small and therefore unsuitable for visual inspection.

A cursor, usually used in the computer art, is of gray or white square image. If such a cursor is used for specifying an image or an principal part of the image having colors identical or similar to the cursor, the cursor will be hard to be significantly distinguished from the specified image.

A different problem of the conventional video type color film analyzers is to specify the number of prints for each picture frame to be printed. Since the specified number of prints can not be displayed on any part of the analyzer, it is impossible to confirm the specified number of prints at any desired time. Furthermore, if the same number of prints is required for all of the picture frames should be printed, it is usual to specify the same number for each picture frame. This is quite troublesome inspection work.

Object of the Invention

It is, therefore, an object of the present invention to provide a video type color film analysing method and apparatus in which simulated color images are easily judged in color balance and/or density.

It is another object of the present invention to provide a video type color film analysing method and apparatus in which a specifying mark is displayed overlapping with an specified image and is significantly visually recognizable.

It is still another object of the present invention to provide a video type color film analysing method and apparatus in which a specified image is displayed being magnified.

It is a further object of the present invention to provide a video type color film analysing method and apparatus in which a number of prints can be specified not only individually to respective picture frames to be printed but also commonly to all of the picture frames to be printed.

It is a still further object of the present invention to provide a video type color film analysing method and apparatus in which a number of prints individual to a specified picture frame prior to a number of prints common to all of the picture frames to be printed if both of the numbers are specified as to the specified picture frame.

It is a yet further object of the present invention to provide a method of displaying a cursor or mark which is significantly recognized.

Summary of the Invention

The above and other objects of the present invention can be achieved by providing a method and apparatus for displaying color images of a plurality of picture frames and a plurality of standard reference images having proper color and density in a matrix pattern on a color image display device.

Image data of the standard reference images and the color images of the plurality of picture frames to

be displayed on the color display device are stored in an image memory. The image memory is divided into a plurality of memory blocks corresponding to columns or lines of the matrix image pattern to store separately the image data of the reference images and the images of picture frames. The reference images are recorded in a magnetic floppy and read out every time color films are analysed.

In analysing or inspecting a color film, the standard reference images having proper density and color balance are displayed in an image matrix. Image data of a plurality of picture frames are provided by a color TV camera one by one and displayed in a plurality of columns or lines of the image matrix. The displayed image of each picture frame is compared with the standard reference images displayed in a line or a column on the display device and evaluated or analysed or inspected. If an image is evaluated unfavorable to print, the image is specified to enter image correction data. If any one of the images displayed on the image display device is specified, the column or line of images of the image matrix including the specified image is shifted adjacent to the column or line of the standard reference images, it is thereby made quite easy to compare the specified image with the standard reference images.

According to an preferred embodiment of the present invention, when specifying any one of images of a plurality of picture frames displayed in a matrix on the image display device, a mark or cursor is displayed overlapping the specified image. The mark or cursor is preferably colored differently from the color of the part of the specified image where the mark or cursor is inlaid.

This differently colored mark or cursor is used to significantly indicate that the image with the mark or cursor is under inspection or evaluation or that the specified image is unfavorable to print.

According to another preferred embodiment of the present invention, when specifying any one of images of a plurality of picture frames, the specified image is magnified and displayed at the center of the screen of the image display device and, on the other hand, the remaining images are disappeared.

According to still another preferred embodiment of the present invention, when specifying any one of images of a plurality of picture frames displayed on the image display device and then entering data of the number of prints to be made from the specified image picture frame, the number is displayed overlapping the specified image. If specifying a section formed between two spliced films and then enter the number of prints to be made, the number is displayed on an image of the spliced section and the number of prints is available for all of the picture frame to be printed.

Brief Description of the Drawings

The description refers to the accompanying drawings in which like reference characters refer to like parts throughout the several drawings, and wherein:

Figure 1 is a perspective view showing a color film analyzer embodying the present invention;

Figure 2 is a block diagram showing the color analyzer of Fig. 1;

Figure 3 is a block diagram showing an image signal processing section of Fig. 2;

Figure 4 is a block diagram showing details of an image memory of Fig. 3;

Figure 5 is an illustration of a screen of a color image display device;

Figure 6 is an illustration of part of a film consisting of a plurality of rolls of films spliced one another;

Figure 7 is a flow chart illustrating the sequence of color film inspection;

Figure 8 is a flow chart illustrating the sequence of displaying a cursor for specifying an image;

Figure 9 is a flow chart illustrating the sequence of transforming gradation;

Figure 10 is an illustration of a screen of a color image display device according to another embodiment of the present invention;

Figure 11 is a flow chart illustrating the sequence of specifying the number of prints individual to each picture frame prior to that common to the respective picture frames to be printed;

Figure 12 is a block diagram showing another embodiment of an image signal processing section;

Figure 13 is an illustration of a screen of a color monitor showing an image arrangement before specifying a subject image;

Figure 14 is an illustration similar to Fig. 13 but after having specified a subject image;

Figure 15 is a block diagram showing another embodiment of an image signal processing section;

Figure 16 is a functional block diagram illustrating a calculation procedure of exposures and a procedure of providing lookup table data;

Figures 17 to 19 are illustrations of a screen of a color monitor showing various embodiments in which a specified image is magnified.

Detailed Description of the Invention

Referring now to the drawings, in particular Figs. 1 and 2, a color film analyzer is shown having a color film analyzer unit 10 and an operation unit 32. The color film analyzer unit 10 includes film supply and film take-up reels 11 and 12 detachably mounted thereon. The film supply reel 11 has a film 13 consisting of a number of rolls of color negative films spliced one another wound in a roll therearound. The spliced color film 13 is withdrawn from the film supply reel 11 by means of a drive roller 16 and guide rollers 14 and 15 to position picture frames thereof at a measuring station. Above the measuring station, there is a sensor unit surrounded 58 with a hood 17 for measuring each picture frame at the measuring station. Between the feed roller 16 and the measuring station there is a notch sensor 50 supported by an arm 18 for detecting notches 113 (see Fig. 6) formed in association with picture frames to be printed.

The spliced color film 13 is further transported to an image pick-up station where a mirror 82 surrounded with a hood 21 is disposed. At the image pick-up station, an image of a picture frame is reflected by the mirror 82 and picked up by a color TV camera 83. For independently, separately positioning each picture frame at the measuring and image pick-up stations, a utility space 22 is provided to temporarily store the analysed part of the spliced color film 13 in a loop therein. Between the utility space 22 and the hood 21 there is an arm 23 supporting a spliced section sensor for detecting spliced sections of the spliced color film 13 and a notch sensor 50 for detecting the notches 113. After the image pick-up station the spliced color film 13 is further transported with a drive roller 24 and guide rollers 25 and 26 and wound up around the take-up reel 12.

A floppy loading slot 28 is provided through which a magnetic floppy 29 with image data of standard reference image or images recorded thereon is loaded. A tape perforator 88 is incorporated in the color film analyzer unit 10 to punch a paper tape 30 to form printing data code in the paper tape after the analyzation of the spliced color film 13. The printing data includes common data to all picture frames of the spliced film 13 and individual data peculiar to the individual picture frame of the spliced film 13. Such common data preferably includes data on film type, film size (full size or half size), the common number of prints to be made from the respective picture frames, etc. of the spliced film 13. On the other hand, the individual data includes data on exposure correction, the number of prints to be made from the picture frame, or the needlessness of print, etc.

On the operation unit 32 there are a color monitor 33 with a large size screen 33a and a keyboard 34. This color monitor 33, which displays color images of picture frames of the spliced film 13 to be analysed on the screen, may be a color CRT or, otherwise as desirable, a liquid crystal display panel. The keyboard 34 has various keys such as alphabetical and numerical keys 38, color keys 35, density keys 36, correction keys 37, operation keys 39, picture frame specifying keys 40 and a page change key 41, and a display screen 42. The color keys 35 include correction keys for cyan, magenta and yellow. For each color, a plurality of correction keys are provided to correct color stepwise. The density keys 36 has a single line of density correction keys to correct density stepwise. The alphabetical and numerical keys 38 are used to enter data on printing condition, the number of prints to be made, film type and film size. The operation keys 39 include various keys for starting the analyzation of color film, printing cut the entered correction data, designating display modes, or the like. The picture frame specifying keys 40 comprise 16 keys corresponding to 16 picture frames and are used to designate or specify one of the images displayed on the screen 33a prior to the entry of data as to the image. The page change key 41 is used to replace quickly an image frame including a plurality of color images displayed on the screen 33a of the color monitor 33 with another image frame. The display screen 44 displays the data

entered.

The color monitor 33 can display images of a plurality of picture frames of the spliced film 13 in various display modes. For example, the image frame can be displayed in a sixteen-division display mode or twelve-division display mode, or even in single-division display mode. Any desired display mode can be selected with the operation keys 39 before inputting image data of picture frames of the spliced film 13 through the color TV camera 83. When displaying the images of picture frames of the spliced film 13 in the sixteen-division display mode, the screen 33a is, as is shown in Fig. 5, notionally divided into four lines (A, B, C and D), each being divided into four divisions, namely sixteen divisions, and displays positive color images 45 of sixteen picture frames, one on each division of the screen 33a. It is noted that the images of the respective division lines A - D are arranged in order of image inputting through the color TV camera 83. That is, the images in the division line A are inputted prior to those of the division line B and accordingly the images in the line D are lastly inputted among all of the images in the lines A - D. It is also noted that a left-hand image is inputted prior to a right-hand image adjacent thereto in each line. If selecting or designating the twelve-division display mode, four standard reference images having standard colors and densities are read out from the magnetic floppy 29 and displayed in the last or bottom line D while images of twelve picture frames inputted through the color TV camera 83 are displayed in the lower three lines A - C of the screen 33a. If selecting or designating the single-division display mode, an image of a single picture frame is magnified four times or more as large as a usually displayed image size and displayed within central four divisions of the screen 33a.

As was previously noted and shown in Fig. 2, the color film analyzer includes the notch sensor 50 supported by the arm 18 detects a notch 113 formed in association with a picture frame to be printed to provide an appropriate notch signal which in turn is sent to a central processing unit (CPU) 52 through an I/O port 51. Since the distance between the notch sensor 50 and the measuring station is previously known, a picture frame with a notch 113 can be positioned at the measuring station by advancing the spliced film 13 by the distance after the detection of the associated notch 113. For effecting such film advancement, a pulse motor 53 is used and driven with a controlled number of drive pulses.

A film framing mask or carrier 54 is disposed to place each picture frame of the spliced film 13 in position at the measuring station. The picture frame in the film framing mask 54 is illuminated with the light emitted from a lamp 55 and passed through a condensor lens assembly 56. The light, after passing through the picture frame of the spliced film 13 placed on the film framing mask 54, is focussed measured with a scanner unit 58 and with the respective color sensors 59, 60 and 61 for red, green and blue, all of them are surrounded with the hood 17. The scanner unit 58 includes a focusing lens 62 and an image area sensor 63 to photoelectrically

convert light passed through respective pixels of the picture frame and focused thereon into time-serial image signals. After being converted into digital image signals by A/D converter 64, the time serial signals are sent to a operation unit 65 comprising a eight-bit microcomputer and converted thereby into logarithmic signals which are used as density signals. The density signals thus obtained are stored in a memory. Then, the density signals for pixels within a previously specified area of the picture frame are read out to calculate a arithmetical mean density of the specified area of the picture frame. In such a manner as described above, arithmetical mean densities are calculated as to a central area, upper and lower half areas excepting the central area, respectively. Based on a distribution of the densities of these areas of the picture frame, a density pattern is determined and according to which an appropriate exposure calculation formula is selected to calculate an appropriate exposure correction value. The correction value thus calculated is stored in a RAM 67.

The color sensors 59 to 61 for red, green and blue measure large area transmittance densities (LATDs) of each picture frame of the spliced film 13 placed in position on the film framing mask 54 to provide appropriate electric signals (LATD signals) which in turn are, after being converted into digital signals in A.D converter 64, send to the CPU 52 through the I/O port 51. Based on the LATD signals, a correction value and a transmittance rate of ND filter are calculated for each color in the CPU 52 and stored in the RAM 67.

On the opposite sides of the film framing mask 54 there are two pairs of rollers 68 and 69 driven by a pulse motor 53. A motor controller 70 controls the rotation of the pulse motor 53 so as to advance and place the spliced film 13 in position.

After the measurement, the spliced film 13 is again transported passing through the utility space toward the image pick-up station. Before the image pick-up station there is the notch sensor 71 and the spliced section sensor 72 supported by the arm 23. The notch sensor 71 detect notches 113 to provide electric notch signal which in turn are sent to the CPU 52 through the I/O port 51 and used to place picture frames as was previously noted. The spliced section sensor 72 detects spliced section between each two rolls of films of the spliced film 13 to provide electric spliced-line signals which are also sent to the CPU 52 through the I/O port 51. When receiving a notch signal, the CPU 52 provides image data based on which a blank image 46 is displayed to indicate that a spliced section is between the picture frames whose images are displayed on the divisions adjacent to and on both sides of the blank image.

At the image pick-up station there is a film framing mask 73 to place picture frames of the spliced film 13 in position. An image frame on the film framing mask 73 is illuminated with the light emitted from a lamp 75 passing a mixing box 74 and then an ND filters assembly 76. The ND filter assembly 76 has two ND filters which are controllably moved in opposite directions in a plane perpendicular to the optical path by a pulse motor 77. Specifically, the ND filters

are moved away from each other and displaced from the optical path for excessively over-exposed picture frames or close to each other and placed in the optical path for excessively under-exposed picture frames. Each picture frame is judged at the measuring station whether it is properly exposed, over-exposed or under-exposed.

On both sides of the film framing mask 73 there are two pairs of rollers 78 and 79 driven by a pulse motor 80. The motor controller 70 controls the rotation of the pulse motor 80 so as to advance and place picture frames with notches 113 of the spliced film 13 in position at the image pick-up station in order. An image of each picture frame placed at the image pick-up station is reflected with the mirror 82 surrounded with the hood 21 and directed to the color TV camera 83 built in the analyzer unit 10. The color TV camera 83 picks up the image to provide color image signals R, G and B for red, green and blue, and synchronizing signals Sync. These color signals R, G and B are, after being subjected to image processing in a image processing section 84, sent to the color monitor 33. A write controller 85 generates address signals based on the synchronizing signals Sync and controls to write data in the image processing section 84 with the address signals. A read controller 86 is controlled with the CPU 52 to generate address signals for reading out data from the image processing section 84 and synchronizing signals to be sent to the color monitor 33.

A floppy drive 87 reads out image data of the standard reference images and writes them in the image processing section 84. The perforator 88 is actuated upon the completion of analyzation to punch the paper tape 30 to form punched codes on common and individual printing data in a paper tape 30. IN the ROM 89 various data, such as fixed printing data, operation program data and the like. Work RAM 90 is used to back up image data.

Referring to Fig. 3 showing an embodiment of the image processing section 84 of Fig. 2. It is noted that image signal processing systems for red, green and blue are all identical and therefore only one, for example, for red is representatively shown in Fig. 3. As shown, red image signals R provided from the TV camera 83 are, after amplified in an amplifier circuit 95, sent to a clamp circuit 96 to establish a reference level. Then, the red image signals are converted into digital signals in an A/D converter 97 and then sent to a logarithmic transformer 98 which comprises a look-up table memory. The logarithmic transformer 98 transforms the digital image signals into logarithmic value as image signals proportional to densities. The CPU 52 writes a data table stored in the ROM 89 in the logarithmic transformer 98 before picking up an image of the picture frame on the film framing mask 73 with the TV camera 83.

A chroma correction circuit 99 is provided commonly to the three colors to correct the difference of spectral sensitivity between a color paper and the image pick-up element of the TV camera 33 and comprises three look-up table memories 99a for the respective color each of which is used to weight the corresponding color image

data, and an adder 99b which adds outputs, namely weighted image data, from the three look-up table memories 99a together and outputs the resultant data as red image data. The CPU 52, before starting film analyzation, reads out three pairs of coefficients from the ROM 89 and changes them stepwise, providing three look-up tables for effecting chroma correction for red which are written in the corresponding look-up table memory 99a.

The image data thus corrected in chroma is then sent to either one of image memories 101a and 101b which is designated or selected by a demultiplexer 100. Each image memory 101a, 101b has a memory capacity sufficient for one full image area (which is hereinafter referred to as one page) of the screen 33a of the color monitor 33 and is alternately read out and written in. Therefore, while reading out image data for one page from the image memory 101a under the control of the read controller 86, image data for new page provided from the TV camera 83 can be written in the image memory 101b by the write controller 85. When the read controller 86 starts to read out the image data for the new page from the image memory 101b, the write controller 85 starts to overwrite in new image data for another page in the image memory 101a. As apparent from the above, the provision of the image memories 101a and 101b for storing two pages avoids the suspension of film analyzation during reading in image data.

For controlling the writing in or reading out image data in the image memory 101a or 101b with the CPU 52, there is an interface 102. The image data read out from either one of the image memories 101a and 101b is sent to a gradation or contrast transforming circuit 104 through a multiplexer 103 wherein the image data is subjected to negative-to-positive transform and gradation transform processing. The gradation transforming circuit 104 comprises sixteen look-up table memories one individual to each of sixteen picture frames constituting one full image frame. In each look-up table memory table data on the result of measurement and table data prepared according to a manually inputted color correction value of each picture frame are written by the CPU 52. These table data can be provided by shifting the standard table data for each color stored in the ROM 89 with reference to color correction value.

The image data thus gradation-transformed is converted into serial signals in a parallel-to-serial converter 105 and then into analog signals in a D/A converter 106. The image signals in analog form are sent to the color monitor 33.

Referring now to Fig. 4, the image memories 101a and 101b are shown in detail. Each memory comprises four memory blocks each of which has four memory areas. In each memory area stores image data of a single picture frame. For example, the fourth-from-the-top line of memory block has four memory areas A1 to A4 to store the image data of the picture frames to be displayed in the bottom line A on the screen 33a of the color monitor 33 as shown in Fig. 5. The third line of memory block has four memory areas A5 to A8 to store the image data of the picture frames to be displayed in the third-from-the-top line B on the screen 33a of the

color monitor 33. The image memory 101b is identical in structure and operation to the other 101a and each memory area of the image memory 101 is specified with reference character B.

Fig. 6 shows part of the spliced film 13 including a spliced line. Two rolls of film 110 and 111 are connected between picture frames 110a and 111a to each other with a splicing tape 112. The spliced film 13 comprises a number of rolls of films are connected to one another with such splicing tape 112. The splicing tape 112 can be optically detected with the spliced line sensor 72. It is noted that the splicing tape 112 is made of materials, such as white adhesive tapes, having reflective or transmittance factors different from that of the spliced film 13. Upon the spliced line sensor 72 detects the splicing tape 112, the CPU 52 provides data for a blank division and writes it in a corresponding memory area of current image memory, for example the image memory 101a.

The operation of the color film analyzer depicted in Figs. 1 through 4 is best understood by reviewing Figs. 7 to 9, which are flow charts illustrating various sequences. After switching on the color film analyzer, to adapt the color film analyzer correspondingly to printing condition to which a printer to be used is set, one or more of the alphabetical and numerical keys 38 of the keyboard 34 are operated to select the same printing channel as that of the printer. Thereafter, the type and size of the spliced film 13 and other necessary data are entered by operating the alphabetical and numerical keys 38 and then a display mode, for example the sixteen-division display mode, is designated.

After mounting a reel 11, a leader tape attached to the leading end of the spliced film 13 is automatically threaded and wound around the take-up reel 12. When the spliced film 13 is advanced by means of the drive roller 16 driven by the pulse motor 53, the notch sensor 50 detects a first notch 113 to provide a notch signal. At the presence of the notch signal, drive pulses applied to the pulse motor 53 are counted to meter an advanced length of the spliced film 13. Upon counting a sufficient number of drive pulses to advance the first notch 113 by a length equal to the distance between the notch sensor 50 and the center line of the film framing mask 54 at the measuring station, the pulse motor 53 stops its rotation so as to place the picture frame with the first notch 113 in position in the film framing mask 54 at the measuring station.

The picture frame with the first notch 113 in the film framing mask 54 is illuminated with the lamp 55 and measured with the scanner 58 to detect densities of the respective pixels of the picture frame. At the same time, the color sensors 59-61 for red, green and blue detects red, green and blue LATDs of the picture frame. Thereafter, the pulse motor 53 starts again to rotate to advance the spliced film 13 until detecting a second notch 113 and places a picture frame with the second notch 113 in position in the film framing mask 54 at the measuring station. The same procedures as for the image frame with the first notch 113 are repeated for all picture frames with notches 113.

The first notch 113 of the first picture frame thus measured is again detected with the notch sensor 71 between the measuring station and the the image pick-up station. Upon the detection of the first notch 113, drive pulses applied to the pulse motor 80 are counted to meter a predetermined length of advancement of the spliced film 13. Thus, the first picture frame is placed in position in the film framing mask 73 at the image pick-up station. During the positioning the first picture frame at the image pick-up station, based on the LATDs detected with the color sensors 59-61, the first picture frame is judged whether it has been properly exposed, excessively over-exposed or excessively under-exposed. If the first picture frame is excessively over-exposed, the CPU 52 actuates the pulse motor 77 to remove or displace the ND filters 76 from the optical path, having the increase of the quantity of light with which the first picture frame is illuminated. On the other hand, if the first picture frame is excessively under-exposed, the CPU 52 actuates the pulse motor 77 to place or insert the ND filters 76 into the optical path, having the decrease of the quantity of light with which the first picture frame is illuminated.

Since the ND filters 76 have been adjusted in position before the first picture frame is placed in position at the image pick-up station, as soon as the first picture frame is placed at the image pick-up station, the TV camera can pick-up an image of the first picture frame to provide time serial image signals separately by color. The time serial image signals for red, green and blue are sent to the image processing section 83 and therein subjected to analog-to-digital conversion, chroma correction, storage and gradation transforming. As was previously described in connection with Fig. 3, the red image signals are, after amplified and clamped, converted into red image data in the A/D converter 97. the red image data is then converted into data proportional to density and sent to the chroma correction circuit 99. There, the respective density-proportional image data are multiplied by coefficients, respectively. The resultant red image data thus obtained is sent to an image memory, for example the memory 101a, designated by the demultiplexer 100 and written in the first memory area A of the sixteen memory areas designated by the write controller 85. In the same manner, the following picture frames are placed at the image pick-up station in order and images of the picture frames are picked up with the TV camera 83. Image data of these picture frames are written in the memory areas A2, A3, of the image memory 101a in order.

Upon advancing the spliced film 13, the spliced line sensor 72 optically detects the splicing tape 112 attached to and splicing the rolls of films 110 and 111 to provide a splice signal and sends it to the CPU 52. The CPU 52 writes "blank" data, namely "zero" in digital form, in a memory area between the areas wherein image data data of the adjacent picture frames of the spliced films 110 and 111. For example, the "zero" data is written in the memory area A11 of the image memory 101a to display a blank on the

division 46 of the screen 33a. On the division of the screen on the left hand side of the division 46 an image of the last picture frame of the film 110 is displayed and on the division of the screen on the right hand side of the division 46 an image of the first picture frame of the film 111 is displayed.

When having written image data of the sixteen picture frames including a spliced section as a splice frame in the image memory 101a, the demultiplexer 100 selects the other image memory 101b and simultaneously the CPU 52 begins to read out image data from the image memory 101a. In such a way, the image memories 101a and 101b are changed alternately inversely to write-in and read-out modes.

When the image memory 101a is in the read-out mode, the read controller 86 reads out image data from the image memory 101a and sends them to the gradation transforming circuit 104 through the multiplexer 103 for negative-to-positive image conversion and gradation transforming. Since the gradation transforming circuit 104 has a lookup table memory for each division of the screen 33a and corrects image data in gradation with a lookup table data of the corresponding division where the image data is displayed as a positive image. The respective lookup table memories stores table data generally different from one another according to images of the respective picture frames. The table data is, as was previously described, provided by shifting the standard table data stored in the ROM 89 with reference to density correction value based on data detected by the scanner 58 and color correction value based on data detected by color sensors 59-61.

The image data thus corrected in gradation are converted into serial signals with the parallel-to-serial converter and then into analog signals with the A/D converter 106. The analog image signals are sent to the color monitor 33 by color to display one page of positive color images of the sixteen picture frames, namely fifteen positive color images 45 and one blank image 46, on the respective divisions of the screen 33a. These images are practically separated with white margins from one another on the screen 33a.

Because the images displayed on the screen 33a of the color monitor 33 are temporarily simulated as printed images, they should be judged whether they are suitable in color balance and color density. Since a spliced section of the spliced film 13 is displayed as the blank image 46 on the screen 33a, the first picture frame of each roll of film ca be identified. Generally, it may be desirable to finish prints of one roll of film with a same tone. For this reason, it is effected to judge whether all of the images between two blank images are substantially similar in color and density.

If the simulated image on any division of the screen is not suitable, the picture frame specifying keys 40 of the keyboard 34 are operated to identify or designate the picture frame having the unsuitable simulated image. As a result, as shown in Fig. 8, the image data of the picture frame thus specified is read out from the image memory 101a and written in the work RAM 90 through the interface 102. Then

from the work RAM 90, image data of part of the specified image where an image of the cursor 47 is to be inlaid is read out and sent to the CPU 52. The image data of the part of the specified image are converted from negative form to positive form and changed to image data of the the cursor 47.

Generally, when inlaying an image of the picture frame identifying cursor 47 in a specified image on the screen 33a, the image of the picture frame identifying cursor 47 is preferred to be significantly different in color from part surrounding the cursor image. For making the image of the picture frame identifying cursor 47 different in color from the image of the specified image to be inlaid with the cursor image, the image data of the cursor 47 is compared with the image data of the specified image stored in the work RAM 90 to judge the similarity or identity of color between the both data. If in fact these data are similar or identical in color, the data of the cursor image is added or subtracted by a constant value.

The image data of the cursor 47 thus obtained is sent to the image memory 101a through the interface 102 which is temporarily changed to the write-in mode and written in the memory area from which the image data of the specified image has been read out. The image data written in the image area of the image memory 101a is converted from negative form to positive form in the gradation transforming circuit 104 and therefore the image of the cursor 47 is displayed in a positive image as part of the specified positive image. If in the event that a wrong picture frame is specified, a clear key is operated to rewritten image data of the wrongly specified picture frame temporarily in the work RAM 90 in the corresponding memory area of the image memory 101a. Thus, the image of the wrongly specified picture is displayed on the screen 33a without the image of the cursor 47.

After the specifying of an picture frame, the color key 35 and/or density key 36 are operated to enter color and/or density manual correction data. According to the manual correction data, a lookup table data of lookup table memory corresponding to the division where the image of the specified picture frame is renewed to correct the image of the specified picture frame in color and/or density. If the first correction is insufficient, the color key 35 and/or density key 36 are operated again. If an image of another picture frame is required to be corrected in color and/or density, the picture frame specifying keys 40 are operated to write the image data of the previously specified picture frame temporarily stored in the work RAM 90 in the image memory 101a through the interface 102. Thereafter, the image data of the another specified picture frame is read out from the image memory 101a and written in the work RAM 90. Thus the image data of previously and newly specified picture frames are replaced with each other. Thus the image of the cursor 47 disappears from the corrected image of the previously specified picture frame and appears in the image of the newly specified picture frame. The image of the newly specified picture frame can be corrected in color and/or density in the same manner.

When making prints at the time developing a roll of film, the printer automatically provides one print for each picture frame. Therefore, it is not necessary to specify the number of print to be made. However, more than one prints are requested, the numbers of prints to be made are specified for the respective picture frames. In addition, when extra prints will be requested later, the number of extra prints is to be specified as to the picture frame. For this, after specifying the picture frame through the picture frame specifying key 40, the numerical keys 38 of the keyboard 34 are operated to enter the number of extra prints. The CPU 52 reads out image data of the picture frame specified from a memory area, for example the memory area A8, of the image memory 101a and stores temporarily them in the work RAM 90. The temporary storage of image data is effected to display the original image of the specified picture frame on the screen 33 when the specified number of prints is disappeared from the screen by operating the clear key. The CPU 52 provides image data of the number of prints and writes it in the memory area A8 of the image memory 101a. Data of the specified picture frame and the number of prints, of which data are read out simultaneously, are displayed as an inlaid image on the screen 33. In this embodiment, the number 48 is displayed as a bright image with a square dark background.

When a same number of prints are requested for all of the picture frames of a roll of film, the division 46 where a blank image at the head of a series of images of the picture frames of the roll of film is displayed is specified through the frame picture specifying keys 40. then, the number of extra prints to be made for all the picture frames is specified. As a result, a specified number 46a is displayed substantially at the center of the specified division 46 as a bright image with a dark background.

In the case that a same number of extra prints are requested for almost all of the picture frames of a roll of film excepting some picture frames, after specifying a division of blank image and the number of prints common to the almost all of the picture frames, each exceptional picture frame and the number of prints of the exceptional picture frame are specified. The common number and exceptional numbers are both stored in the RAM 67 and recorded as punched codes in the paper tape 30 after the completion of negative film analyzation.

If the image displayed on the screen 33 is blurred or has no major subject, the picture frame specifying keys 40 are operated to specify the picture frame of the image and then the key 39 is operated to instruct no necessity of making a print of the specified picture frame. As a result, the image data of the specified picture frame stored in a memory area of the image memory 101a, for example the memory area A2, is transferred to the work RAM 90 and part of the image data of the specified picture frame is retrieved, converted into negative image data and then written in the memory area A2. In such a way, an image of the specified picture frame with a negative center area is displayed on specified division of the screen 33a. The negative center area forms a print-needless mark 49. This mark 49 may be colored

if desired.

When all of the displayed images are analysed and judged to be suitable, the page change key 41 is operated to replace the analysed images with the following page of images. The image data of sixteen picture frames including or not including a spliced section are read out from the image memory 101b and displayed as positive images on the screen 33a of the color monitor 33 in the same manner as the previous page of images. During the analysis of the following page of images, another sixteen images are picked up by the TV camera and image data of the sixteen picture frames are written in the image memory 101a.

When all of picture frames of the spliced film 13 including a plurality of rolls of films have been analysed, the operation key 39 is operated to record the print data in the RAM 67 as punched codes in the paper tape 30. The paper tape is punched to record data codes indicating, for example, the spliced section 46, film type and film size, common data including the number of prints common to all of the picture frames in this order and thereafter, exposure correction data and prints number or print-needless data of each picture frame in order or frame number.

The data tape 30 is set in a printer for making prints from the analysed spliced film 13. The printer reads the common data first and sequentially the data individual to each picture frame required to be printed upon making prints of the required picture frame. According to these data, the printer is controlled to make favorable prints. The printer is provided with color sensors for detecting red, green and blue large area transmittance densities (LATDs). According to the detected LATDs exposures for red, green and blue are determined. Based on the exposures and exposure correction data read from the data tape 30, actual exposures are obtained with which the printer controls the proportion of three colors of printing light.

When having selected to display one page of images in the twelve-division display mode, the magnetic floppy 29 is set in the color film analyzer. The color film analyzer reads the four reference images from the floppy 29 and writes them in the work RAM 90. The image data of the reference images are read out and written in the memory areas A13-A16 of the image memory 101a and the memory areas B13-B16 of the image memory 101b which are corresponding to the first or uppermost line of divisions D of the screen 33a of the color monitor 33. Accordingly, images of the spliced film 13 are picked up by twelve frames and displayed in lower three lines of divisions A-C of the screen 33a.

Upon analysing images of the spliced film 13 displayed in the lower three image lines A-C are compared with any one or all of the reference images in the first image line D to simulate favorable images.

When having selected to display an image in the single image display mode, the image pick-up and display is effected by picture frame. In this case, the image data of one picture frame is magnified and displayed on the central four divisions of the screen 33a of the color monitor 33. The magnification of image is effected either in an electrical interpolation

of image data or in shortening the sampling period of the A/D converter 97. This image magnification may be effected to any one of images displayed in the sixteen or twelve division display mode when the one image is specified for color correction.

Referring now to Fig. 9 showing the sequential operation of gradation transforming, each picture frame of the film placed at the measuring station is measured with the scanner 63 and color sensors 59-61 to detect densities of each pixel of the picture frame and LATDs of the picture frame for red, green and blue, respectively. The LATDs are arithmetically averaged to provide a gray mean density. The gray mean density thus obtained is compared with reference gray mean densities of the excessively over-exposed picture frame and of the excessively under-exposed picture frame. If the gray mean density of the measured picture frame is higher than the reference gray mean density of the excessively over-exposed picture frame, the measured picture frame is judged excessively over-exposed. On the other hand, if the gray mean density of the measured picture frame is lower than the reference gray mean density of the excessively under-exposed picture frame, the measured picture frame is judged excessively under-exposed. According to the decision, the ND filters are controlled to make a proper exposure in the previously described manner. For an excessively over- or under-exposed picture frame, color correction values for cyan, yellow and magenta are calculated base on the LATDs. For picture frames other than such excessively over- and under-exposed picture frames, color correction values for red, green and blue are calculated based on the LATDs.

The scanner 58 scans the picture frame at the measuring station to detect densities of a number of points within a previously specified area. From the densities an arithmetic mean density is calculated for the specified area. In a same manner, arithmetic mean densities for a plurality of areas of the picture frame. Based on the mean densities, the picture frame is classified to a normally illuminated scene or back-lit scene. A density correction value for each color is calculated by using one of previously provided operation formulas according to the classified scene.

The color correction value and density correction value thus obtained are added together by color and then written in the RAM 67. Here, density correction is represented by a correction value for cyan, magenta or yellow and the density correction value is added to the color correction value after being converted into a color correction value by color. Based on the added correction value a gradation transforming value is calculated for each color with which the standard table data is shifted. These calculations are performed after the measurement of the picture frame and before the following picture frame is placed at the measuring station.

As was previously described, the ROM 89 stores standard table data different according to colors for the respective colors. Accordingly each standard table data is read out being shifted according to the gradation transforming value of corresponding color

and then written in corresponding area of the gradation transforming circuit 104.

If a manual correction is effected, a manually inputted color correction value and a manually inputted density correction value in the form of a color correction value are added to the color correction value read out from the RAM 67 and based on which a gradation transforming value is calculated to shift again the standard table data. Thereafter, the shifted standard table data is written in the gradation transforming circuit 104.

Referring now to Fig. 10 showing the screen 33a of the color monitor 33 on which images of sixteen picture frames of the spliced film 13 are displayed. In this embodiment, the number of prints for the respective picture frames of a roll of film is not specified. Therefore, the respective divisions of the screen 33a of the color monitor 33 don't display any number thereon even in the central division on which a spliced section of the spliced film 13 is displayed as a blank image 46.

Referring now to Fig. 11 showing the sequential operation of specifying individually the numbers of prints for the respective picture frames of a roll of film included in the spliced film 13. If the number of prints is specified commonly to the respective picture frames of a roll of film, the individually specified number of prints is preferentially used in printing. The number of prints for a specified picture frame is entered as an individual printing data and is stored in the RAM 67 correspondingly to image data of the specified picture frame. If the number of prints is specified as a printing data commonly to a plurality of picture frames of the roll of film of the spliced film 13, the common number of prints is also stored in the RAM correspondingly to image data of each picture frame. The CPU 52, when the common and individual numbers of prints are specified for a picture frame to be printed, writes preferentially, not the common number of prints, but the individual number of prints in the RAM 67. Accordingly, it is not happened to form double punched codes of the number of prints in the paper tape. Describing in more detail following Fig. 11, when specifying individually the number of prints for a picture frame of the spliced film 13, the picture frame is specified to store image data of the picture frame in the RAM 67. Then, data of the number of prints is specifically entered through the numerical keys 38. The CPU 52 makes a first decision whether an individual number of prints is specified for the specified picture frame. If the answer is yes, the CPU 52 stores data of the individual number of prints in the RAM 67 correspondingly to the image data of the specified picture frame and displays the specified individual number on the division of the screen 33a where the specified picture frame is displayed. Thereafter or when the answer to the first decision is no, the CPU 52 makes another decision whether a common number of prints is specified for the spliced section. The answer to the other decision is yes, the CPU 52 stores data of the common number of prints correspondingly to the image data of the specified picture frame if the specified picture frame has no individual number of prints. Then, the common

number of prints is displayed. If the answer to the other decision is no, the last two steps are omitted.

Referring to Fig. 12 showing another embodiment of the image processing section 84 of Fig. 2. It is noted in this embodiment that elements which are identical in structure and operation to those of the previously described embodiment in association with Fig. 3 are designated by the same reference numerals and need not be explained again.

The image data for red corrected in the chroma correction circuit 99 is sent to either an image memory 120 through a demultiplexer 100. The image memory 120 comprises four memory blocks having four memory areas A1-A4, A5-A8, A9-A12 and A13-16, respectively. Each memory area can store image data of one picture frame. The first memory block having the memory areas A13-A16 stores image data of the four reference images 200-203 which are to be displayed on the uppermost division line D of the screen 33a of the color monitor 33 as shown in Fig. 13. The second memory block having the memory areas A9-A12 stores image data of images 45 of four picture frames of the spliced film 13 which are displayed on the second-from-the-top division line C. In such a way, image data of picture frames of the film 13 are stored individually in the memory areas A1-A12. Image data of picture frames of the spliced film 13 to be printed which are stored in the second to fourth memory blocks of the image memory 120 are sent to a multiplexer 123 through a selector 122. The selector 122 has three input terminals, first to third, and three output terminals, first to third, and changes the connections between the input and output terminals according to a change signal from the CPU 52 so as to substantially exchange in location the third to fourth memory blocks in the image memory 120. By exchanging the connection between the input and output channels, images displayed on the second to fourth division lines B-D can be exchanged by line. Accordingly, any image line can be shifted adjacent to the uppermost reference image line A. This is convenient to compare an image in the image line shifted adjacent to the reference image line with any one of the reference images for color and density inspection. The first block of the image memory 120 is connected directly to the multiplexer 123.

The multiplexer 123 selectively sends image data from the four memory blocks of the image memory 120 to a gradation transforming circuit 124 wherein the image data is subjected to negative-to-positive transforming and gradation transforming processings. The gradation transforming circuit 124 comprises sixteen look-up table memories one individual to each of four reference images and twelve picture frames of the spliced film 13. The lookup table memory for the four reference images carries a standard table data transferred from the ROM 89. Each of the remaining lookup table memories stores table data provided by shifting the standard table data from the ROM 89 according to the result of measurement and a manually inputted correction data.

The red image data thus transformed in gradation by color is converted into serial signals in a

parallel-to-serial converter 125 and then into analog signals in a D/A converter 126. The red image signals thus processed are sent to the color monitor 33. In the just same manner, the image data for green and blue from the TV camera 83 are processed and sent to the color monitor 33. An interface 127 connected to the image memory 120 enables to write in and read out image data from the image memory 120 by the CPU 52.

Before inspecting picture frames to be printed, the magnetic floppy 29 is loaded in the color film analyzer through the floppy loading slot 28. The color film analyzer reads the four reference images 200-203 from floppy 29 and writes them in the work RAM 90. The image data of the reference images 200-203 are read out and written in the memory areas A13-A16 of the image memory 120 which are corresponding to the first or uppermost division line D of the screen 33a of the color monitor 33. Accordingly, images of the spliced film 13 are picked up by twelve frames by the color TV camera 83 and displayed on the lower three division lines A-C of the screen 33a of the color monitor 33.

In analysing or inspecting the images of the picture frames displayed on the lower three image lines A-C are compared with any one or all of the standard reference images 200-203 on the uppermost or the first reference image line D to simulate favorable printed images. If any one of the displayed images of picture frames is judged unfavorable as printed image, the image is specified by operating the picture frame specifying keys 40 of the keyboard 34.

The image data of the specified image is read out from the image memory 120 and written in the work RAM 90 through the interface 127. Then, the CPU reads in image data of part of the image data from the work RAM 90 where an image of a cursor 47 for specifying the picture frame is to be inlaid as shown in Fig. 14. The image data of the inlaying part of the specified picture frame is converted from negative form to positive form and thereby changed to as image data of the inlaid cursor 47.

When inlaying the specified image with the image of the picture frame specifying cursor 47 on the screen 33a, the image of the picture frame specifying cursor 47 is generally preferred to be significantly different in color from part surrounding the cursor image. For this end, the image data of the cursor 47 is compared with the image data of the the specified image stored in the work RAM 90 to judge the similarity or identity in color between the both data. If in fact these data are similar or identical in color to each other, the data of the cursor image is changed to show a different color.

The image data of the picture frame specifying cursor 47 thus obtained is sent to the image memory 120 through the interface 127 and written in the memory area in which the image data of the specified image has been written. The image data of the picture frame specifying cursor 47 written in the image area of the image memory 120 is converted from negative form to positive form in the gradation transforming circuit 124 and therefore is displayed as a positive image as well as the image of the

specified picture frame.

Immediately after the numerical key 40 is operated to specify the picture image, the CPU 52 provides the selector with a change signal to exchange the connections of the input and output terminals so as to connect the memory block in which the image data of the specified image is included to the second image line C. For example, if the image on the third image line B is specified, the selector 123 connects the first input terminal to the second output terminal and the second input terminal to the first output terminal but maintains the connection between the third input and output terminals. As a result, the image data in the second and third memory blocks of the image memory 120 are displayed on the third and second image lines. Thus, the an image line which includes the specified image is shifted adjacent to the reference image line D. Accordingly, an image of any specified picture frame can be located close to the reference images 200-203 as shown in Fig. 14, enabling an easy comparison of the image with the reference images for image evaluation and inspection.

After the specifying of an image, the color key 35 and/or density key 36 are operated to enter color and/or density manual correction data. According to the manual correction data, a lookup table data of lookup table memory corresponding to the division where the image of the specified picture frame is renewed to correct the image of the specified picture frame in color and/or density. If the first correction is insufficient, the color key 35 and/or density key 36 are operated again. If an image of another picture frame is required to be corrected in color and/or density, the picture frame specifying keys 40 are operated. As soon as the operation of the picture frame specifying keys 40, the images exchangeably shifted onto the image lines C and B are shift back onto the image lines B and C originally displayed thereon, respectively and simultaneously the image data temporarily stored in the work RAM 90 are returned into the memory areas of the image memory 120. As a result, the image of the cursor 47 disappears from the corrected image of the previously specified picture frame and appears in the newly specified image. Of course, the image line including the cursor image will shift adjacent to the reference image line D. The newly specified image can be corrected in color and/or density in the same manner.

If no correction is needed for all the images displayed on the screen 33a of the color monitor 33, the next page key 56 is operated. The CPU 52 operates to display images of another twelve picture frames to be printed in the same way as described above.

When all of picture frames of the spliced film 13 including a plurality of rolls of films have been evaluated or inspected and corrected suitably if desired, the operation key 39 is operated to record the print data in the RAM 67 as punched codes in the paper tape 30. The paper tape is punched to record data codes indicating exposure correction data for the respective picture frame to be printed. The data tape 30 is set in a printer for making prints from the

analysed spliced film 13. The printer reads the the data of each picture frame required to print. According to these data, the printer is controlled to make favorable prints well corrected in color and density. The printer is provided with color sensors for detecting red, green and blue large area transmittance densities (LATDs). According to the detected LATDs, exposures for red, green and blue are determined. Based on the exposures and the exposure correction data read from the data tape 30, accurate exposures are obtained for automatically controlling the proportion of the three primary colors of printing light.

Referring now to Fig. 15 showing still another embodiment of the image processing section 84 of Fig. 2. It is noted in this embodiment that elements which are identical in structure and operation to those of the previously described embodiment in association with Fig. 12 are designated by the same reference numerals and need not be explained again.

The image memory 120 stores the image data of four reference images in memory areas A13-A16 of the first block which are displayed on the uppermost division line D of the screen 33a of the color monitor 33 and the images of twelve picture frames of the spliced film 13 in the memory areas A9-A12, A5-A11 and A1-A4 of the second to fourth memory blocks which are displayed on the second to fourth division lines B, C and D, respectively. An interface 141 transfers image data between the image memory 120 and the work RAM 90 or an image magnify circuit 142. The image magnify circuit 142 electrically interpolates the image data of a picture frame specified through the picture frame specifying keys 40 four times as large as the image originally displayed on the screen 33a of the color monitor 33. The interpolated image data is written in the centrally located four memory areas A6, A7, A10 and A11 of the image memory 120. Before writing in the interpolated image data, the image data of four picture frames previously stored in the memory areas A6, A7, A10 and A11 are temporarily stored in the work RAM 90.

A multiplexer 144 selectively sends image data from the four memory blocks of the image memory 120 to a gradation transforming circuit 145 wherein the image data is subjected to negative-to-positive transform and gradation transforming processings. The gradation transforming circuit 145 comprises sixteen lookup table memories one individual to each of four reference images and twelve picture frames of the spliced film 13. The lookup table memory for the four standard reference images 200-203 carries a standard table data transferred from the ROM 89. Each of the remaining lookup table memories stores table data provided by shifting the standard table data from the ROM 89 according to the result of measurement and a manually inputted correction data.

The red image data thus transformed in gradation by color is converted into serial signals in a parallel-to-serial converter (P/S) 146 and then into analog signals in a D/A converter (D/A) 147. The red image signals thus processed are sent to the color

monitor 33. In the just same manner, the image data for green and blue from the TV camera 83 are processed and sent to the color monitor 33.

Referring now to Fig. 16, there is shown details of the operation unit 65 for calculating exposures and providing table data, in cooperation with the CPU 52. The three color signals detected by the scanner 58 are sent to the operation unit 65 through the A/D converter 64. The color signals are transformed in logarithms by the logarithmic transformer 150 to provide three color density signals which in turn are stored in a memory 151 separately by color. The three color density signals are then sent to a image characteristic value drawing section (CVD) 152 for drawing image characteristic values. When an principal image is specified, data on whether each scanned point is of the specified principal image is sent to and stored in a principal image area table section (IAT) 154. With reference to the data in the principal image area table section (IAT) 154, a principal image characteristic value drawing section (ICVD) 153 reads out the three color density signals of points which are of the specified principal image from the memory 151, thereby drawing color image characteristic values of the specified principal image for the respective colors.

The exposure operating section 155 has a plurality of exposure calculation formulas provided for images whose principal image is specified and images of whose principal image is not specified and selects one of the formulas. By substituting the image characteristic values into the selected formula, exposures can be calculated for the respective colors.

The exposure for each color is sent to a corrective exposure operating section 156 and there increasingly or decreasingly corrected stepwise correspondingly to the correction keys (color correction key and density correction key) 37 if operated. The corrected exposure for each color is stored in a memory 157 and also sent to a shifter 158. The shifter 158 shifts the standard table data read out from the ROM 89 with the corrected exposure for each color. For example, a curve of the standard table data (TD) is shifted in the direction of address axis. With this shifted standard table data, the degree of gradation transforming in the gradation transforming circuit 104 is changed. The shifted table data is written in a lookup table memory of the gradation transforming 104 corresponding to the specified image.

Color printers widely spreaded and available are of the LATD printing system. For this reason, the exposure operating section 159 is provided to calculate exposures for the respective colors based on the LATD values. A subtracting section 160 compares the calculated exposures calculated in the exposure operation sections 155 and 159 for each color to obtain the difference of exposure therebetween. This difference of exposure is transformed into the form of a color or density correction step effected with the color or density correction key in a correction step setting section 161. If having previously operated the correction key 37, a step correction section 162 additively or subtractively

sums up the correction steps from the correction step setting section 161 and the correction key 37. The resultant correction step is stored as correction data in a memory 163. At the end of inspection, the correction data is recorded as a punched code in the paper tape 30 with the perforator 88.

For specifying a principal image included in the displayed image of a picture frame on the screen 33a of the color monitor 33, there is provided a principal image specifying means such as a light pen 94 connected to a coordinate position detect circuit 93. When specifying a principal image on the screen 33a of the color monitor 33, the coordinate position detect circuit receives a position signal from the light pen 94 and synchronizing signal from the read controller 86 to provide coordinate signal indicating the coordinate of the pointed position of the screen 33a of the color monitor 33 which in turn is sent to the operation unit 65.

A principal image of an image displayed on the screen 33a of the color monitor 33 can be specified by tracing its outline. Otherwise, the principal image may be specified by pointing partly the principal image. In this case, picture a principal image area is tentatively determined or defined as an aggregate of the picture elements which have three color densities or color identical or similar to those of a point pointed by the light pen 94. In this aspect, a closed area surrounded by picture elements having three color densities or color identical or similar to those of a point pointed by the light pen 94 is judged to be a principal image.

The standard reference images 200-203 and images 45 of twelve picture frames are displayed on the screen 33a of the color monitor 33 in the same manner as described as to the previous embodiments. Each image 45 is compared with the respective standard reference images 200-203 and evaluated or inspected whether it is favorable to print. If there is an image, for example the image 45a, which is unfavorable to print, the picture frame specifying key 57 is operated to specify the image 45a.

Upon specifying the image 45a, image data of four images stored in the memory areas A6, A7, A10 and A11 of the image memory 120 are read out and written in the work ROM 90 through the interface 141. Thereafter, image data of the specified image 45a stored in the memory area A1 is read out and sent to the image magnify circuit 142. The image magnify circuit 142 electrically interpolates the image data of the specified image 45a to magnify the specified image four times as large as the originally displayed image on the screen 33a of the color monitor 33. The interpolated image data is written in the centrally located four memory areas A6, A7, A10 and A11 of the image memory 120. Before writing in the interpolated image data, the image memory is changed to the writing mode.

For transforming the magnified image in gradation, the table data used for transforming the gradation of the specified image 45a originally displayed is written in four lookup table memories connected to the memory areas A6, A7, A10 and A11 of the image memory 120. The table data is provided

by reading out the exposure of the specified image 45a from the 157 in the manner as described above. Then, the image data are read out from the memory areas A6, A7, A10 and A11 of the image memory 120 to display an magnified image 45b at the center of the screen 33a of the color monitor 33 as shown in Fig. 17.

If the magnified image 45b includes a principal subject image, such as a human face, the principal image is traced with the light pen 94. As a result, data representing whether each point of the specified image 45a measured with the scanner 58 is within the principal subject image or not is provided and written in the principal image area table section (IAT) 154. The principal image characteristic value drawing section (ICVD) 153 reads out the three color density signals of points which are of the specified principal image from the memory 151 with reference to the data in the principal image area table section (IAT) 154, thereby drawing color image characteristic values, for example mean densities, of the specified principal image for the respective colors.

The exposure operating section 155 selects one of exposure calculation formulas provided for images whose principal image is specified. By substituting the mean density, LATD value, densities of particularly specified points of the specified image 45a, etc. into the selected formula, exposures can be calculated by for color. The exposure thus calculated for each color is sent to the subtracting section 160 to set new color or density correction steps based on the exposures which are stored in the memory 163. As was described previously, the calculated exposures for the respective colors are stored in the memory 157 and, based on the exposures stored in the memory 157, table data are newly provided for the respective colors. The three table data newly provided are written in the lookup table memories connected to the memory areas A1, A6, A7, A10 and A11 of the image memory 120, respectively. Thereby, the specified image 45a and its magnified image 45b, in particular their principal subject image are well corrected in color and/or density.

If having operated the correction key 37 because the specified image has no principal subject image, data of a correction step number is sent to the corrective exposure operating section 156 and the step correction section 162. When the density key 36 is operated, the corrective exposure operating section 156 increasingly or decreasingly corrects the exposures for the three colors read out from the memory 157 stepwise correspondingly to the number of steps of the operated density key. The corrected exposure for each color is sent to the shifter 158 to provide new table data which is then written in the above noted, five table memories, respectively, thereby correcting the color images 45a and 45b in density. The step correction section 162 additively or subtractively sums up the correction steps from the memory 163 and the the correction steps from the correction key 37 to provide correction data which in turn is stored in the memory 99. When the color key 35 is operated,

exposure of a color defined by the operated color key is corrected and the specified image 45a and the magnified image 45b are corrected in color. The resultant correction step is stored as correction data in a memory 163. If the correction in color and/or density is insufficient, the color key 35 and/or the density key 36 are operated again. For the other images, the same inspection procedures as described as to the image 45a are repeated.

As is shown in Fig. 18, it is preferred to eliminate images which are not specified from the screen 33a while displaying the standard reference images 200-203 and the specified and magnified images 45b. In this case, the work RAM 90 should have a memory capacity sufficient to store image data for twelve picture frames transferred thereto upon specifying an image.

As is shown in Fig. 19, it is also preferred to eliminate all images including the standard reference images 200-203 while displaying an magnified images 45c which is magnified approximately sixteen times as large as the originally displayed image 45a. In this case, only the magnified, large image 45c is displayed on the screen 90, making it quite easy to inspect the specified image. Although the present invention has been fully described by way of the preferred embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention, they should be construed as included therein.

Claims

1. A video type color film analyzer comprising:

image pick up means for picking up images of a plurality of picture frames of a color film in order; and

video image displaying means for displaying simulated print images of said picked-up images in a matrix pattern and a plurality of reference images in one column or line of said matrix pattern.

2. A video type color film analyzer as defined in claim 1, wherein said video image displaying means includes a memory means having a plurality of memory blocks corresponding to columns or lines of said matrix pattern for storing image data of said color images to be displayed.

3. A video type color film analyzer as defined in claim 2, wherein said memory means has one memory block for said reference images and a plurality of memory blocks for said plurality of images picked up by said image pick-up means.

4. A video type color film analyzer as defined in claim 3, wherein said reference images are recorded in a magnetic floppy and transferred to said memory block of said memory means

from said magnetic floppy.

5. A video type color film analyzer as defined in claim 4, further comprising image specifying means for specifying an one of said color images to be corrected in color and/or density and shift means for shifting one of said columns or lines of color images which includes said specified image adjacent to said column or line of said reference color images.

6. A video type color film analyzer as defined in any one of claims 1 to 5, wherein said image pick-up means is a color TV camera.

7. A video type color film analyzer as defined in claim 1, further comprising means for specifying one of said color images whose picture frame need not be printed; and means for displaying an indication mark overlapping part of said specified color image, said mark indicating the unnecessary of print.

8. A video type color film analyzer as defined in claim 7, wherein said indication mark is a negative image of said part where said specified image is to be inlaid with said indication mark.

9. A video type color film analyzer as defined in claim 7, further comprising means for transforming gradation of said images to be displayed on said video image display device to simulate their printed images, means for providing data of a number of prints to be made from a picture frame having said specified image; and means for inlaying said number of prints in said specified image displayed on said video image display device.

10. A video type color film analyzer as defined in claim 9, further comprising means for indicating a position of an principal image of said magnified image on said video image display device, and means for correcting exposures based on characteristic values of said principal image.

11. A video type color film analyzer as defined in claim 10, further comprising means for magnifying said specified image.

12. A video type color film analyzer as defined in claim 10, further comprising means for magnifying said specified image and eliminating the remaining images.

13. A video tape color film analyzer as defined in claim 1, wherein said video image displaying means includes at least two memory means, in one of said two memory means image data of images picked up by said image pick up means being stored while image data is read out from the other memory means to display said images on said screen of said video image display means.

14. A video type color film analyzer for displaying simulated color images of a plurality of picture frames of a color film consisting of a plurality of films spliced to one another in a matrix pattern on a video image display device, said analyzer comprising:

a color TV camera for providing color image data of said plurality of picture frames in order; memory means for storing said color image

data; and

means for reading out said color image data from said memory means to simulate and display color print images of said picture framed;

means for detecting a spliced section between two films spliced to each other to display said detected spliced section as a spliced section image on said image displaying device;

means for specifying one of said images including said spliced section image displayed on said video image display device; and

data inputting means for inputting data of a number of prints of a picture frame having said specified image.

15. A video type color film analyzer as defined in claim 14, wherein said data inputting means inputs a number of prints commonly to all picture frames of a roll of film to be printed following said spliced section when specifying said spliced section image.

16. A video type color film analyzer as defined in claim 14, further comprising inlaying means for inlaying said number of prints inputted through said data inputting means in said specified image.

17. A video type color film analyzer as defined in claim 16, wherein said memory means stores data of said number of prints inputted individually to each said specified image prior to said common number of prints if said individual number of prints is specified.

18. A video type color film analyzer as defined in claim 16 or 17, wherein said spliced section is displayed as a blank.

19. A video type color film analyzer as defined in claim 16 or 17, wherein said spliced section is displayed as a colored blank.

20. A video type color film analyzer for displaying simulated color print image of a plurality of picture frames of a color film and a plurality of reference color images in a matrix pattern on a video image display device, said analyzer comprising:

a color TV camera for providing color image data of said plurality of picture frames in order; memory means for storing said color image data; and

means for processing said color image data read out from said memory means for simulation of color print image of each said picture frame;

said memory means being divided into memory blocks corresponding to columns or lines of said matrix pattern, one of said memory blocks being allocated for storing color image data of a plurality of reference color images and the remaining memory blocks being allocated for storing said color image data of said plurality of picture frames provided by said color TV camera.

21. A video type color film analyzer for displaying simulated color print image of a plurality of picture frames of a color film and a plurality of reference color images in a matrix

pattern on a video image display device, said analyzer comprising:

a color TV camera for providing color image data of said plurality of picture frames in order;

memory means for storing said color image data;

means for processing said color image data read out from said memory means for simulation of color print image of each said picture frame; and

image specifying means for specifying one of said color images to be corrected in color and/or density to shift one of columns or lines of said color image matrix including said specified image adjacent to said column or line of said reference color images.

22. A video type color film analyzer for displaying simulated color print image of a plurality of picture frames of a color film in a matrix pattern on a video image display device, said analyzer comprising:

image specifying means for specifying one of said color images unnecessary to be printed; and

means for displaying an indication mark overlapping with part of said specified color image, said mark indicating the unnecessary of print.

23. A video type color film analyzer for displaying images of a plurality of picture frames of a color film in a matrix pattern on a video image display device, said analyzer comprising: means for specifying one of said displayed images to input a number of prints of said specified image; and means for inlaying said inputted number of print in said specified image.

24. A video type color film analyzer for providing image signals of color images of a plurality of picture frames of a color film consisting of a plurality of films spliced one another and displaying said image signals as color positive images in a matrix on a video image display device, said analyzer comprising: means for detecting a spliced section between two films spliced each other to display said detected spliced section as a spliced section image in said matrix on said image displaying device;

means for specifying one of said images including said spliced section image displayed on said video image display device; and inlaying means for inlaying a number of prints of a picture frame having said specified image overlapping with part of said specified image.

25. A video type color film analyzer for providing image signals of color images of a plurality of picture frames of a color film consisting of a plurality of films spliced one another and displaying said image signals as color positive images in a matrix on a video image display device, a spliced section between two films spliced each other of said color film being displayed as a spliced section image in said matrix on said image displaying device, said analyzer comprising:

means for specifying one of said images including said spliced section image displayed on said video image display device;

means for inputting a number of prints common to all picture frames of one film following said spliced section when said spliced section image is specified or a number of prints individual to each said image when each of said image is individually specified;

means for inlaying a number of prints of said specified image overlapping with part of said specified image; and

memory means for storing data of said number of prints inputted individually to each said specified image prior to said common number of prints if said individual number of prints is inputted.

26. A video type color film analyzer for displaying color images of a plurality of picture frames of a color film in a matrix on a video image display device, color image signals of each said picture frame being provided by a color TV camera and transformed in gradation according to its exposed condition to simulate printed color images of said displayed color images, said analyzer comprising:

means for specifying one of said color images displayed on said video image display device; and

means for magnifying said specified color image on said video image display device.

27. A video type color film analyzer for displaying color images of a plurality of picture frames of a color film in a matrix on a video image display device, color image signals of each said picture frame being provided by a color TV camera and transformed in gradation according to its exposed condition to simulate printed color images of said displayed color images, said analyzer comprising:

means for specifying one of said color images displayed on said video image display device; and

means for magnifying said specified color image on said video image display device and eliminating the remaining images.

28. A video type color film analyzer for providing image data of color images of a plurality of picture frames of a color film by a TV camera and simulating and displaying printed color images of said color images in a matrix on a video image display device, said analyzer comprising:

at least two memory means for storing said image data, one of said two memory means being written with said image data provided by said color TV camera while image data is read out from the other memory means to display said simulated images on said video image display means.

29. A video type color film analyzer for providing image data of color images of a plurality of picture frames of a color film consisting of a plurality of films spliced one another and displaying said image signals

stored in a memory as color positive images in a matrix on a video image display device, said analyzer comprising:

sensor for detecting a spliced section between each two spliced films to provide a signal; and means for providing image data of said spliced section at the presence of said signal and writing said image data in said memory, thereby displaying an image of said spliced section on said video image display device.

30. A method of analysing a color film of which color images of a plurality of picture frames are displayed in a matrix pattern on an image display device, comprising the steps of:

specifying one of said color images of said plurality of picture frames; and displaying a cursor overlapping part of said specified image, said cursor having a color different from a color of said part of said specified image.

31. A method as defined in claim 30, wherein said cursor is shaped square.

32. A method as defined in claim 30 or 31, wherein said cursor has a color identical to a color of said part changed to positive to negative.

33. A method as defined in claim 32, wherein when image data of said cursor which is image data of said positive-to-negative changed part of said specified image is similar to image data of said specified color image, said image data of said cursor is additively or subtractively changed from said image data of said positive-to-negative changed part of said specified image.

34. A method of analysing color films comprising the steps of:

providing image data of images of a plurality of picture frames of a color film; and displaying said image data of said images as simulated print images in a matrix pattern and a plurality of reference images in one column or line of said matrix pattern.

35. A method of analysing a color film consisting of a plurality of films spliced to one another, comprising the steps of: providing color image data of a plurality of picture frames of said color film in order by means of a color TV camera; storing said color image data in memory means; and reading out said color image data from said memory means to simulate and display color print images of said picture framed in a matrix pattern.

36. A method of analysing a color film consisting of a plurality of films spliced to one another, comprising the steps of:

providing color image data of a plurality of picture frames of said color film in order by means of a color TV camera; storing said color image data in memory means; and reading out said color image data from said memory means to simulate and display color

print images of said picture framed in a matrix pattern on an image display device;
 detecting a spliced section between each two films spliced to each other to display said detected spliced section as a spliced section image on said image displaying device;
 specifying one of said images including said spliced section image displayed on said video image display device; and
 inputting data of a number of prints of a picture frame having said specified image.

37. A method of analysing a color film consisting of a plurality of films spliced to one another, comprising the steps of:
 providing color image data of a plurality of picture frames of said film in order by means of a color TV camera;
 storing said color image data in memory means which is divided into memory blocks, one of said memory storing color image data of a plurality of reference color images and the remaining memory blocks storing said color image data of said plurality of picture frames provided by said color TV camera; and
 processing said color image data read out from said memory means to display said color images including said reference images in a matrix pattern on an image display device for simulation of color print image of each said picture frame.

38. A method of analysing a color film consisting of a plurality of films spliced to one another, comprising the steps of:
 providing color image data of a plurality of picture frames of said film in order by means of a color TV camera;
 storing said color image data in memory means;
 processing said color image data read out from said memory means and displaying said images in a matrix on an image displaying device for simulation of color print image of each said picture frame; and
 for specifying one of said color images to be corrected in color and/or density to shift one of columns or lines of said color image matrix including said specified image adjacent to said column or line of said reference color images.

39. A method of analysing a color film consisting of a plurality of films spliced to one another, comprising the steps of:
 providing color image data of a plurality of picture frames of said film in order by means of a color TV camera;
 storing said color image data in memory means;
 displaying said image data as simulated images in a matrix on an image displaying device;
 specifying one of said color images unnecessary to be printed; and
 displaying an indication mark overlapping with part of said specified color image, said mark indicating the unnecessary of print.

40. A method of analysing a color film consisting of a plurality of films spliced one another comprising the steps of:
 providing image data of a plurality of picture

frames of said color film to display said image data as color images in a matrix on a video image display device;

detecting a spliced section between each two films spliced each other to display said detected spliced section as a spliced section image in said matrix on said image displaying device;

specifying one of said images including said spliced section image displayed on said video image display device; and

inlaying a number of prints of a picture frame having said specified image overlapping with part of said specified image.

41. A method of analysing a color film consisting of a plurality of films spliced one another comprising the steps of:

providing image data of a plurality of picture frames of said color film to displays said image data as color images in a matrix on a video image display device;

detecting a spliced section between each two films spliced each other to display said detected spliced section as a spliced section image in said matrix on said image displaying device;

specifying one of said images including said spliced section image displayed on said video image display device; and

inputting a number of prints common to all picture frames of one film following said spliced section when said spliced section image is specified or a number of prints individual to each said image when each of said image is individually specified;

inlaying a number of prints of said specified image overlapping with part of said specified image; and

storing data of said number of prints inputted individually to each said specified image in memory means prior to said common number of prints if said individual number of prints is inputted.

42. A method of analysing a color film consisting of a plurality of films spliced one another comprising the steps of:

providing image data of a plurality of picture frames of said color film;

displaying said image data as color images in a matrix on a video image display device;

means for specifying one of said color images displayed on said video image display device; and

means for magnifying said specified color image on said video image display device and eliminating the remaining images.

FIG. 1

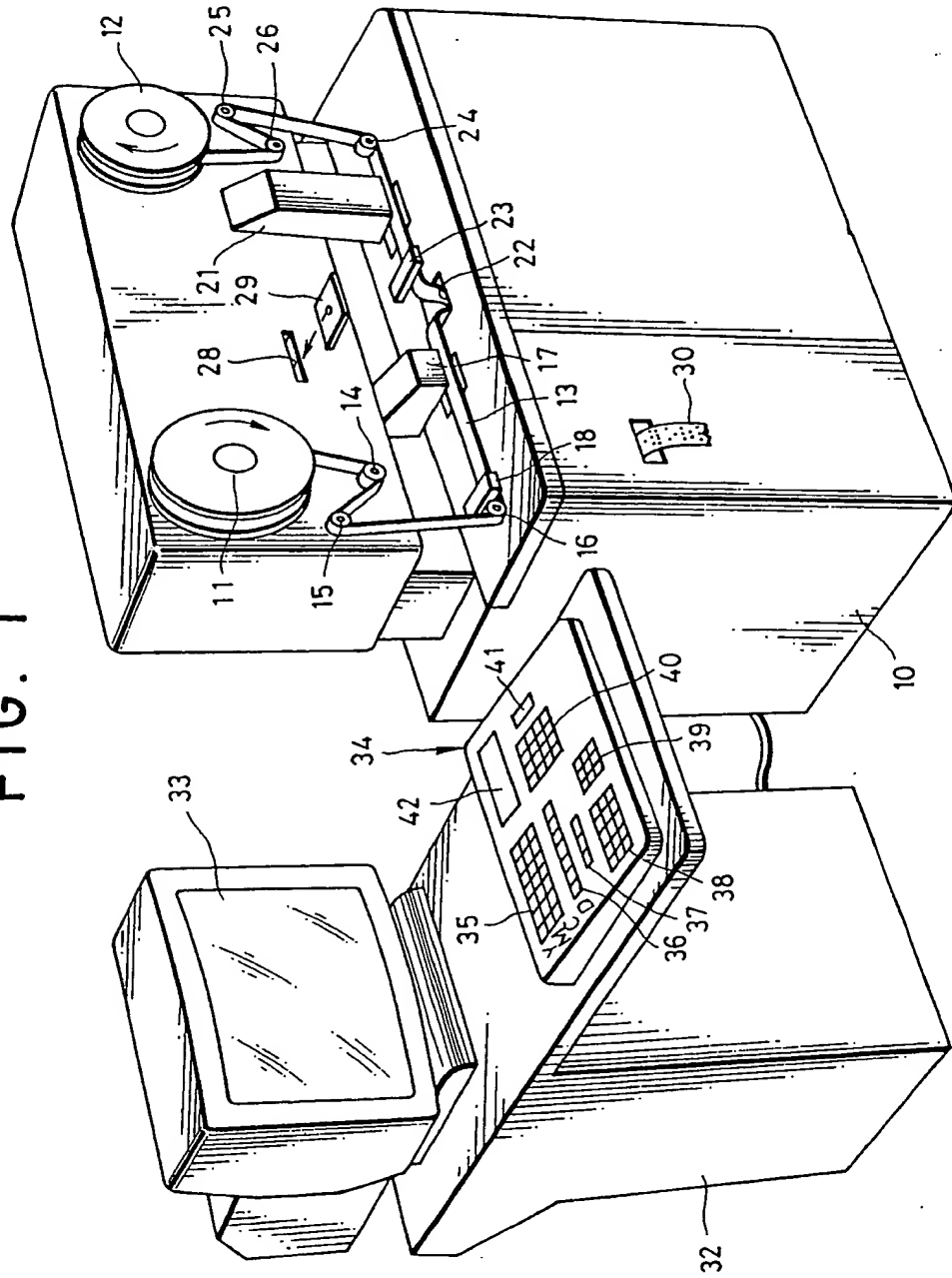


FIG. 2

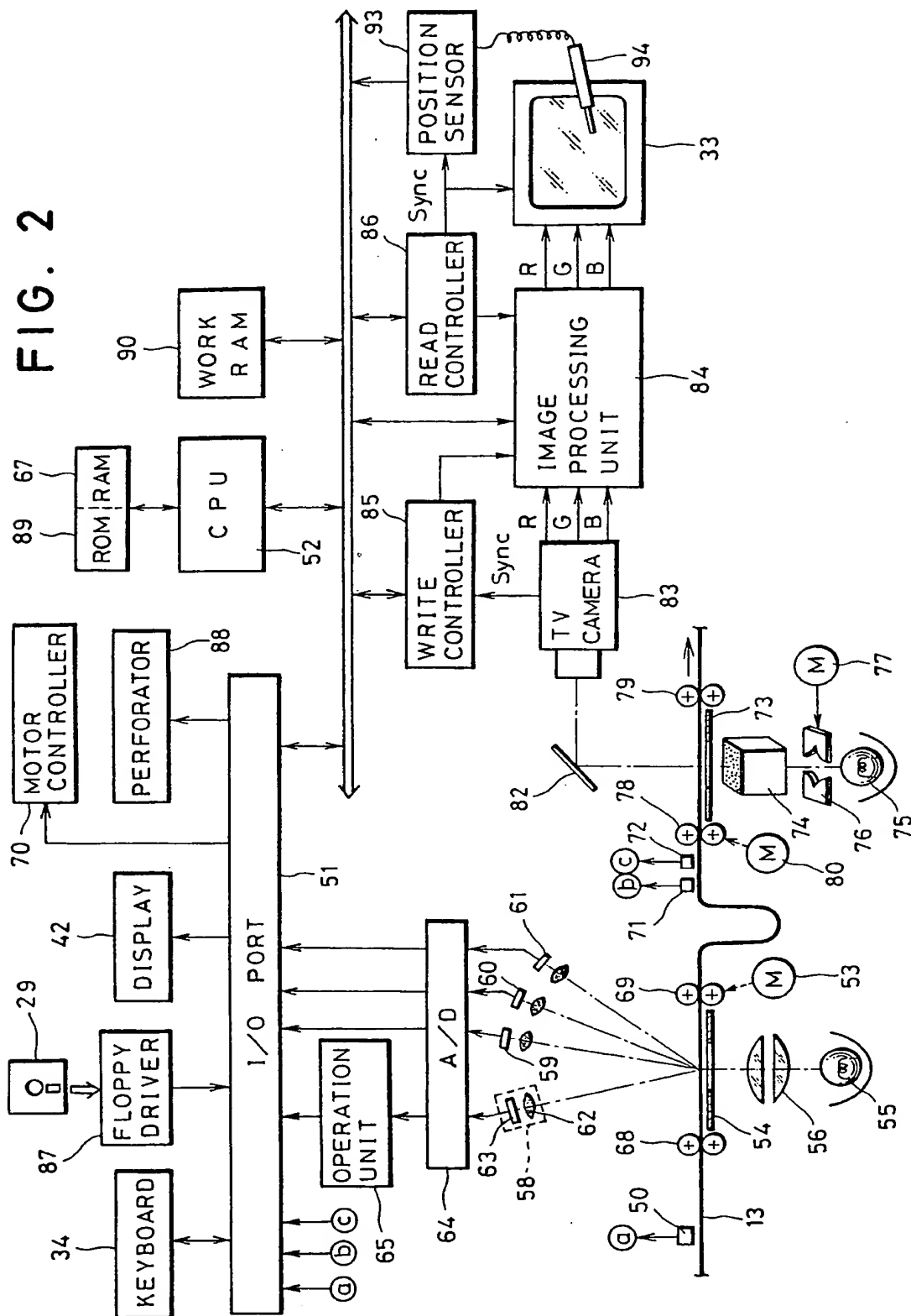


FIG. 3

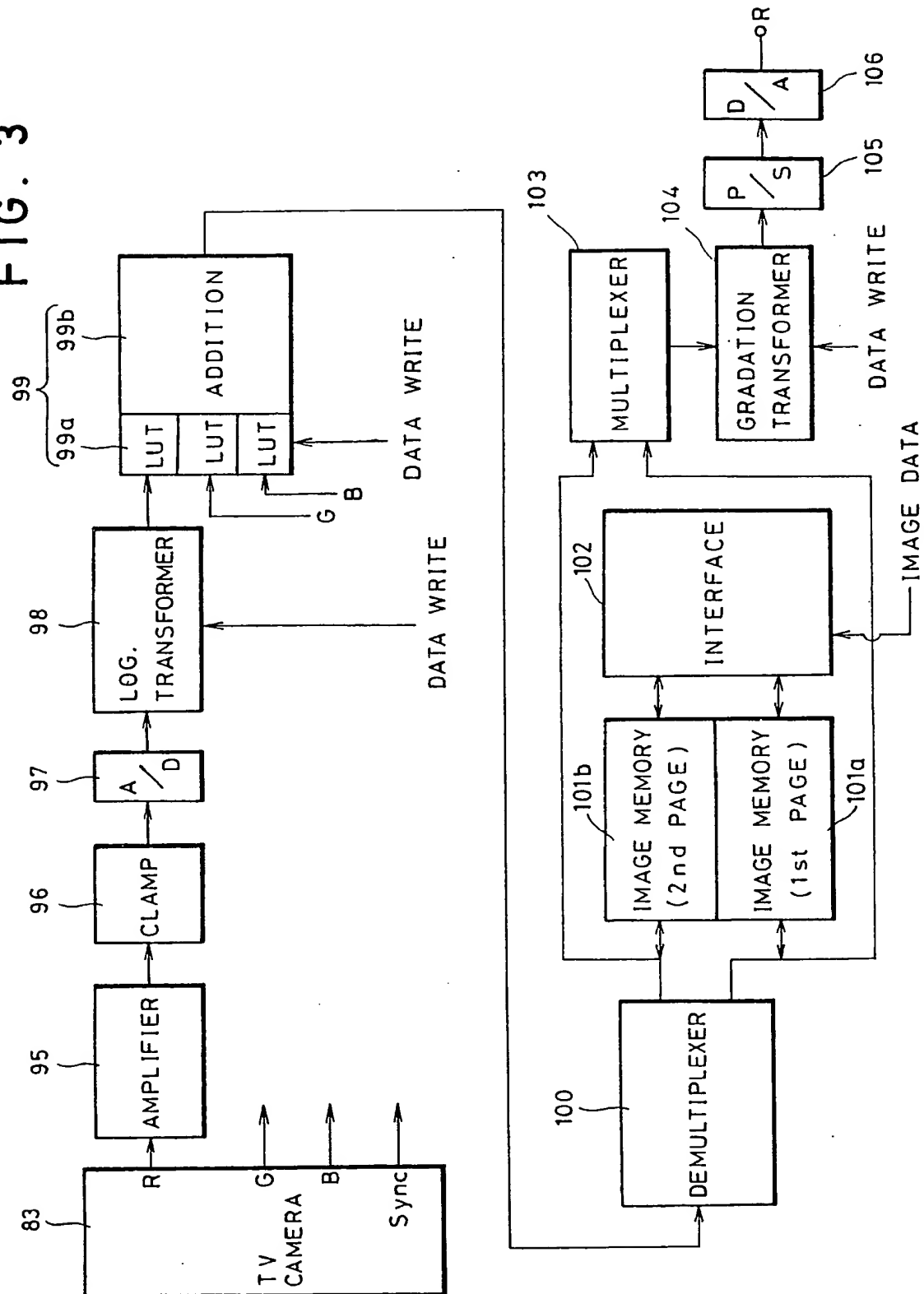


FIG. 4

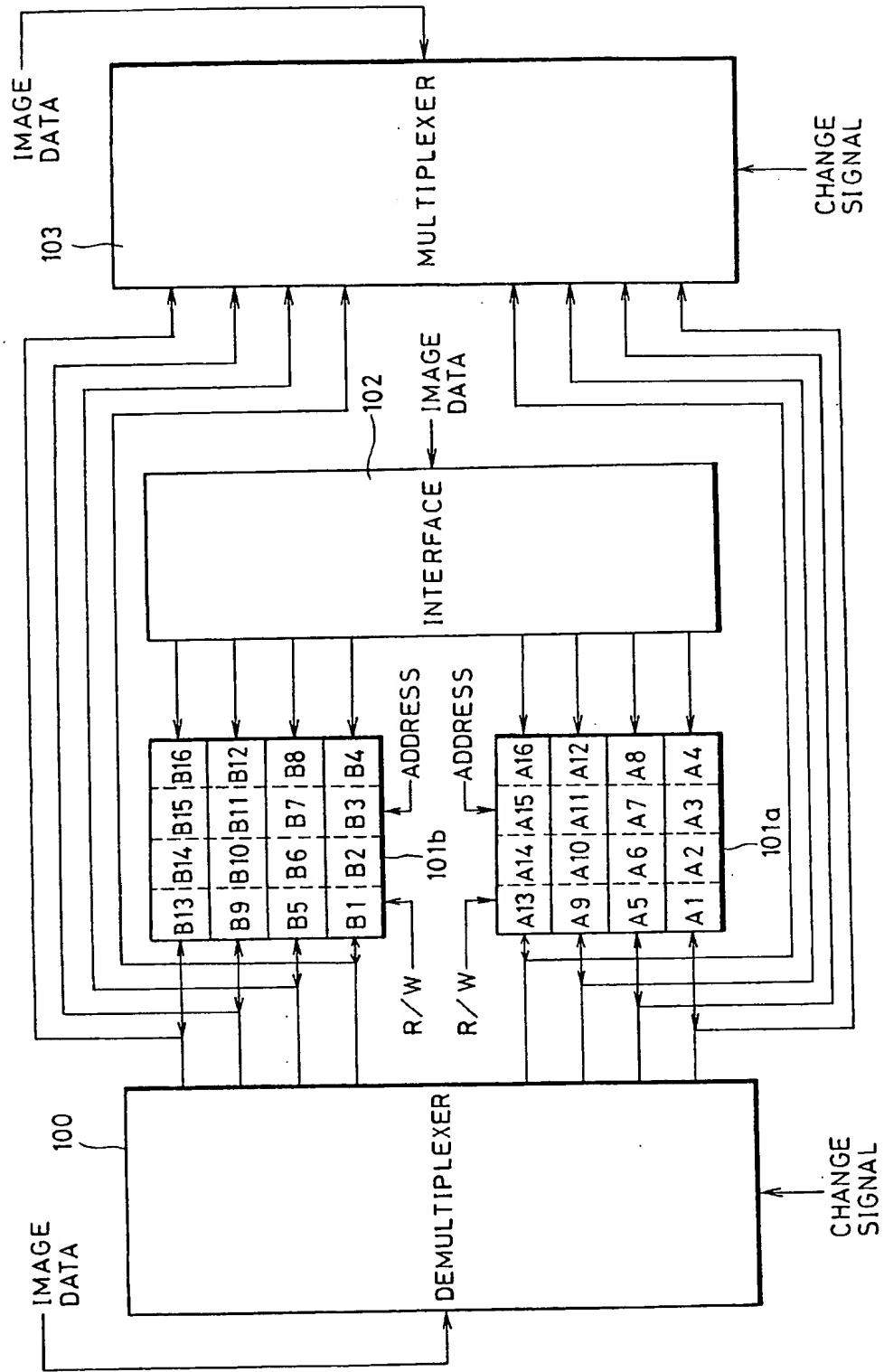


FIG. 5

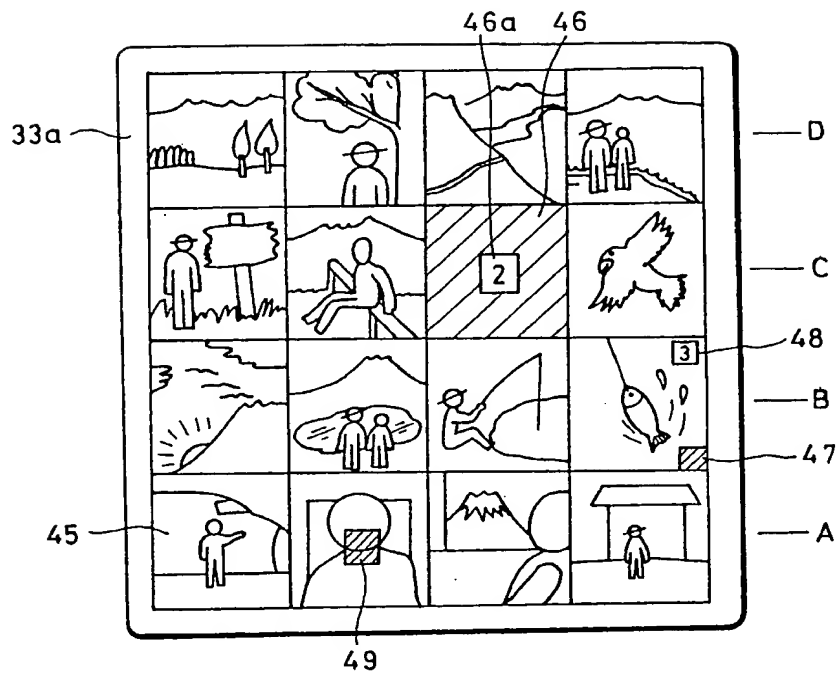


FIG. 6

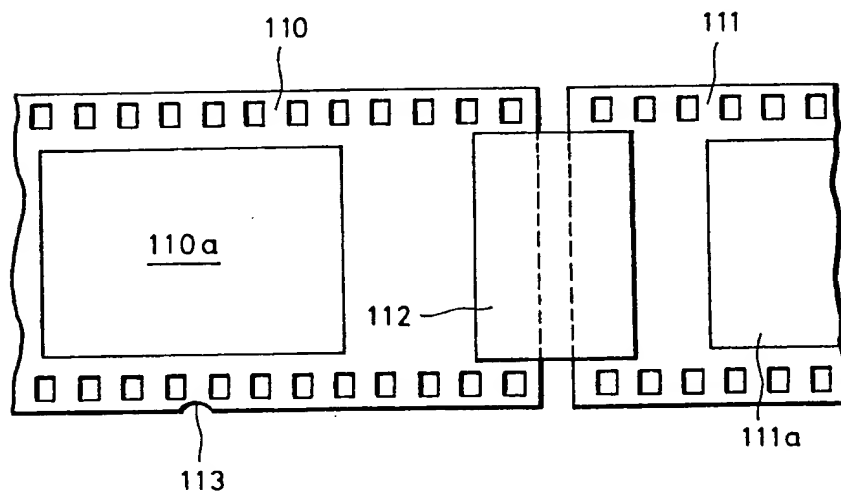


FIG. 7

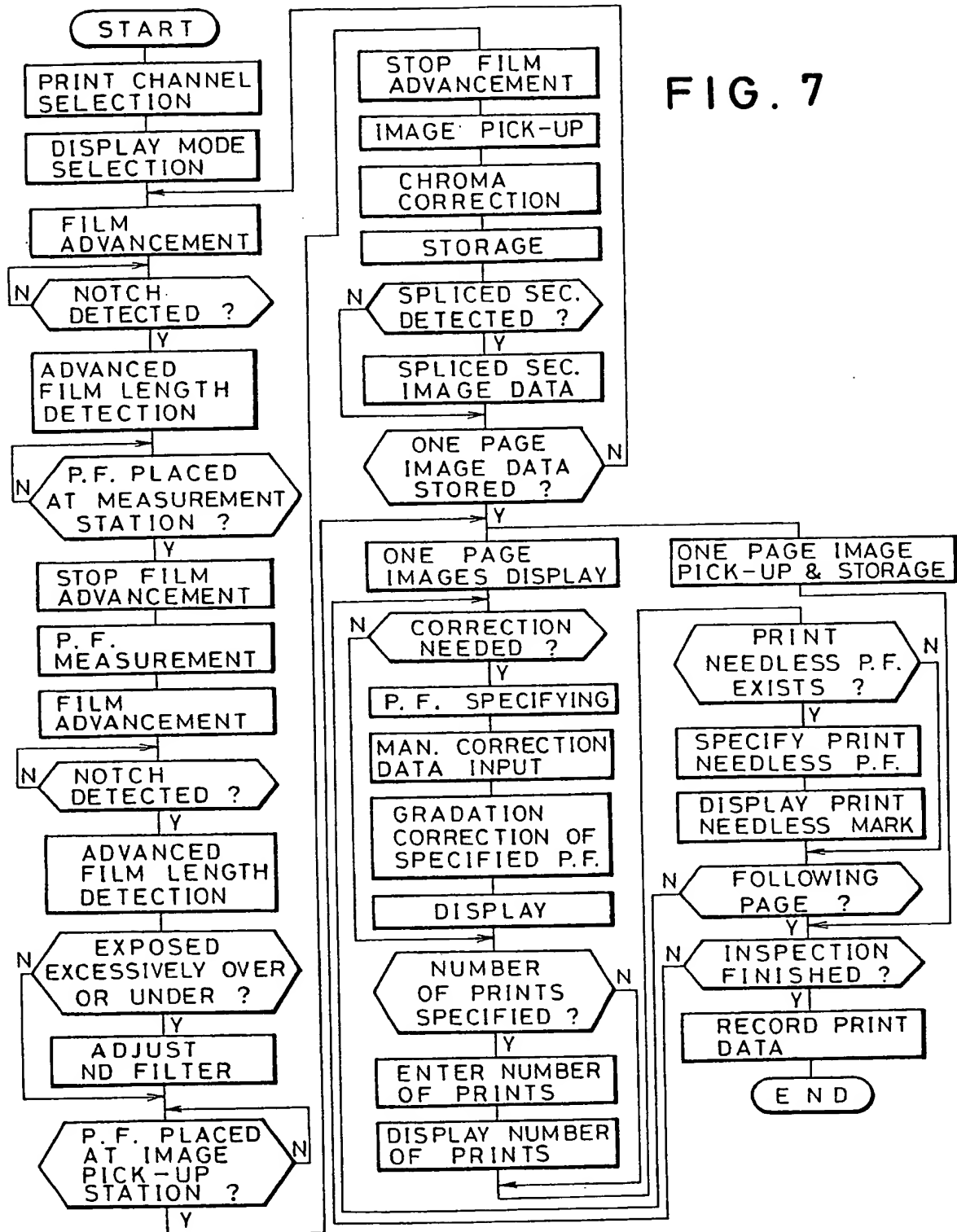


FIG. 8

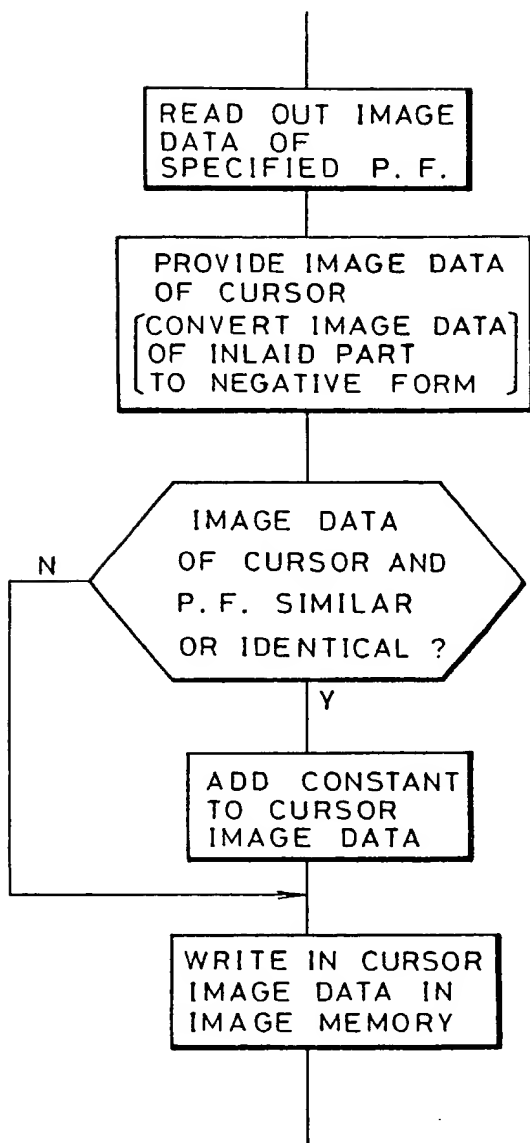


FIG. 9

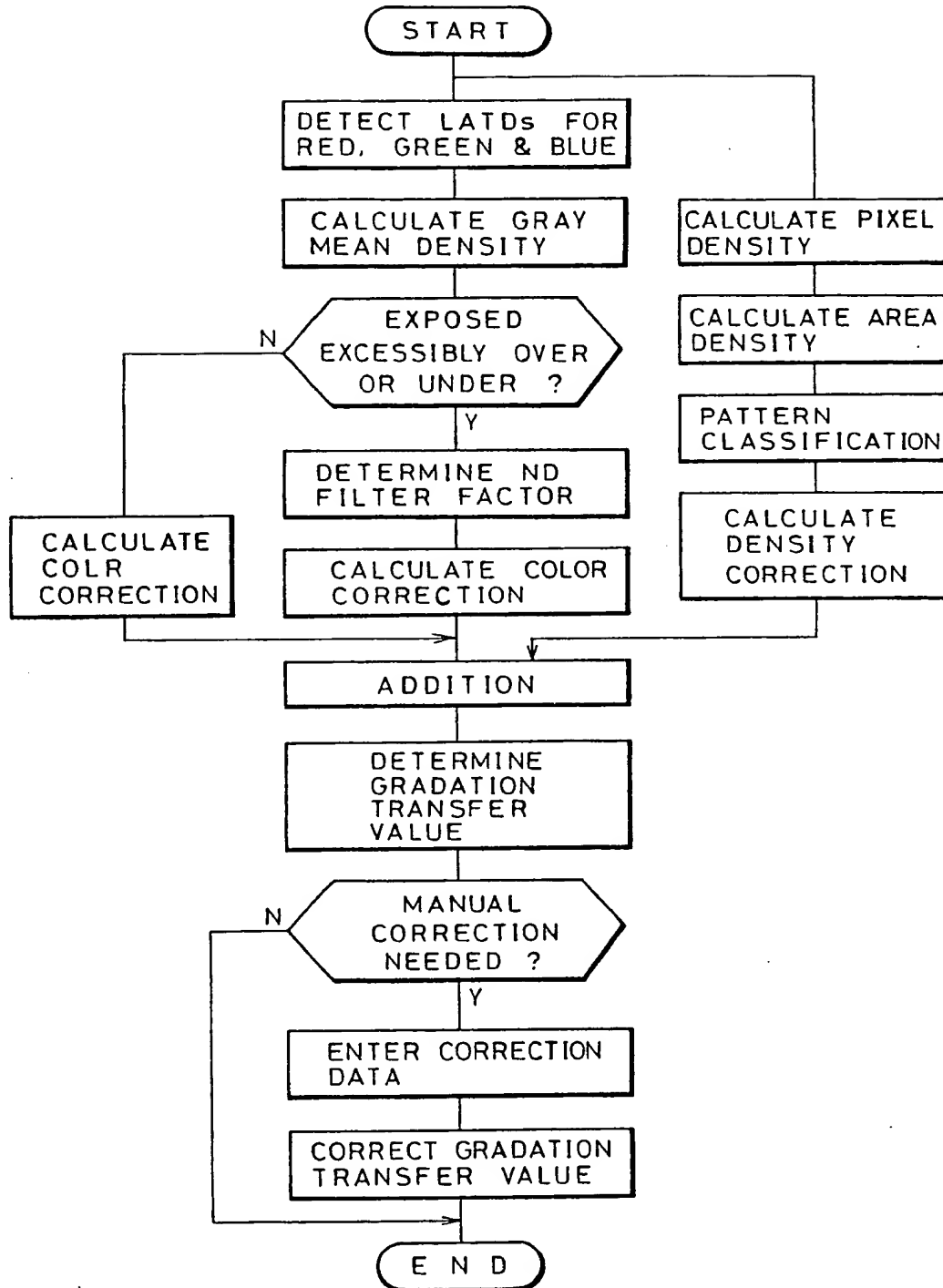


FIG. 10

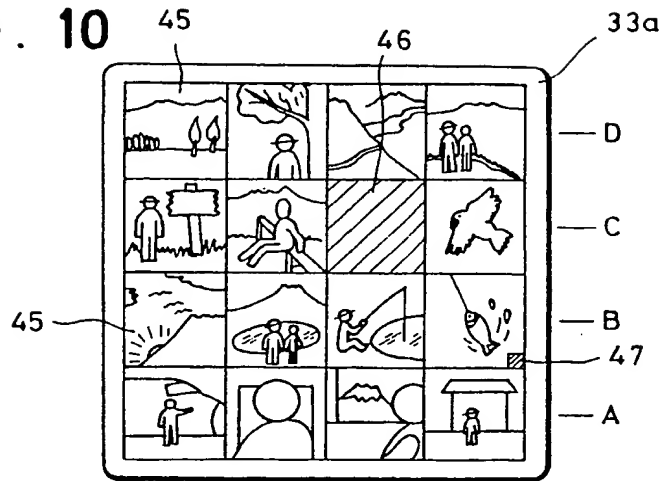


FIG. 13

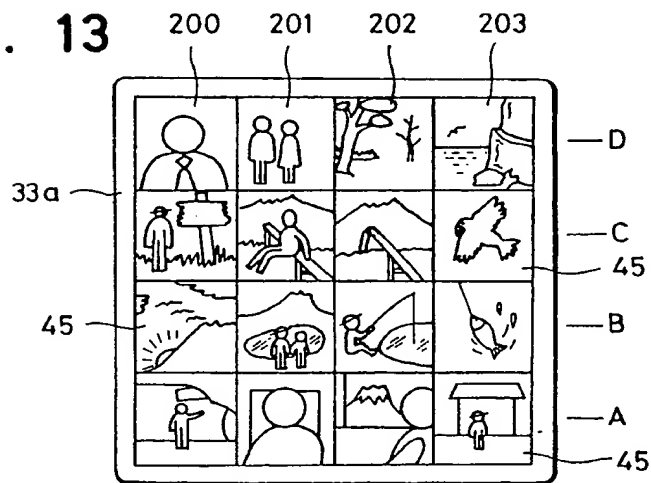


FIG. 14

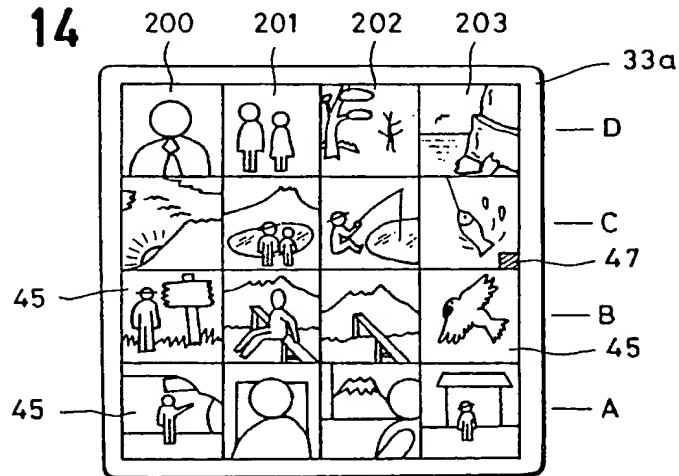


FIG. 11

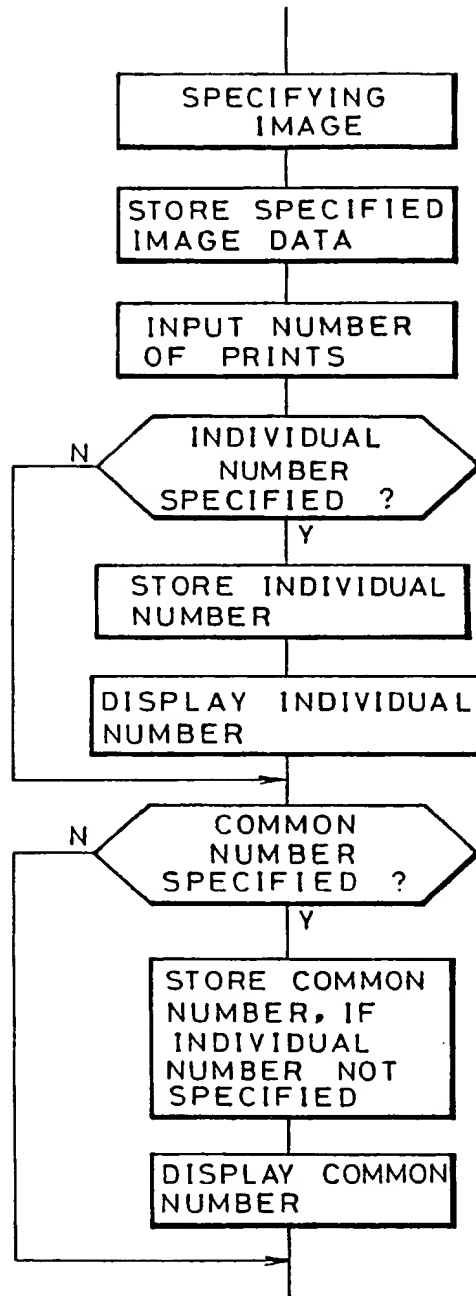


FIG. 12

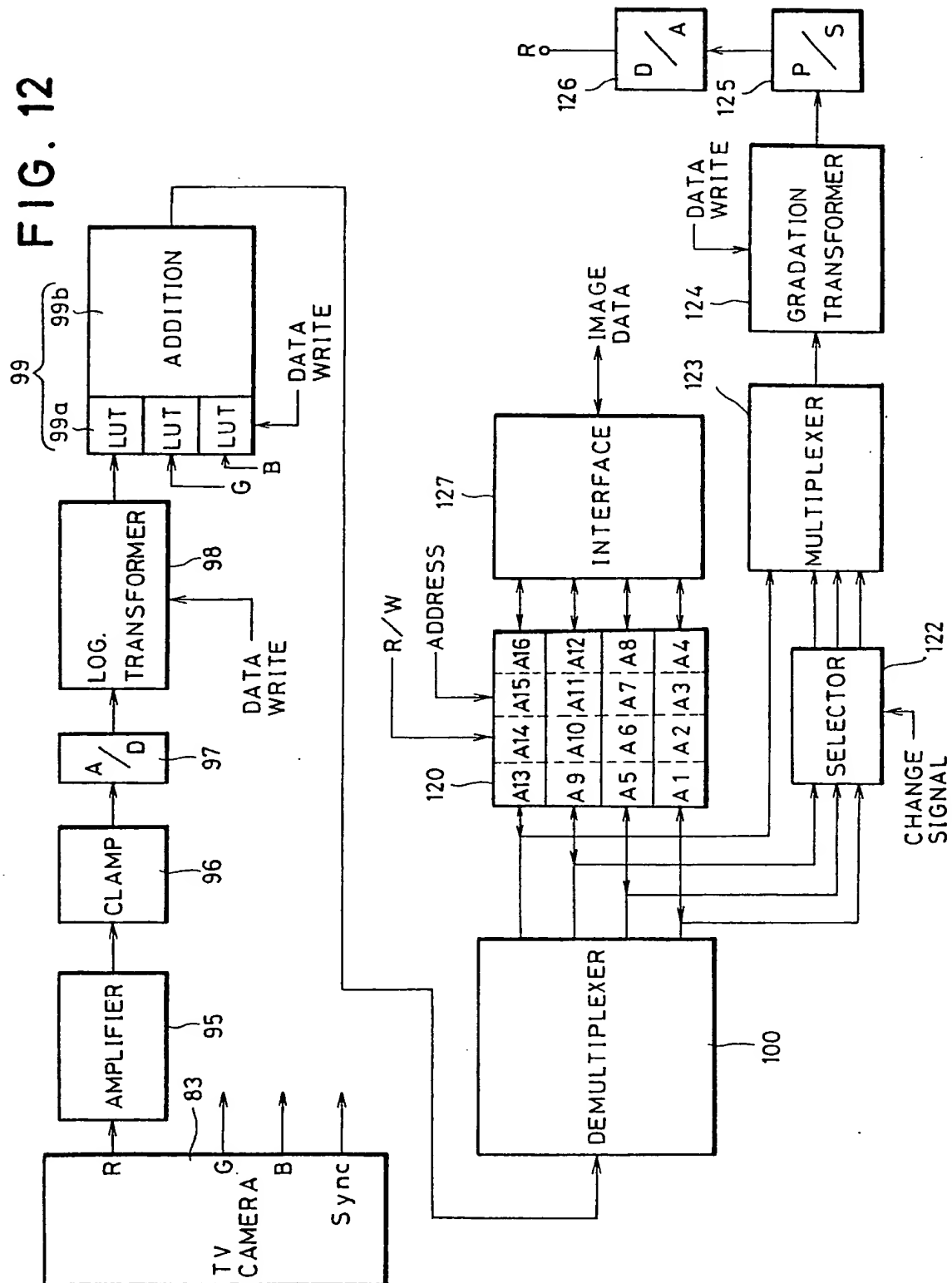
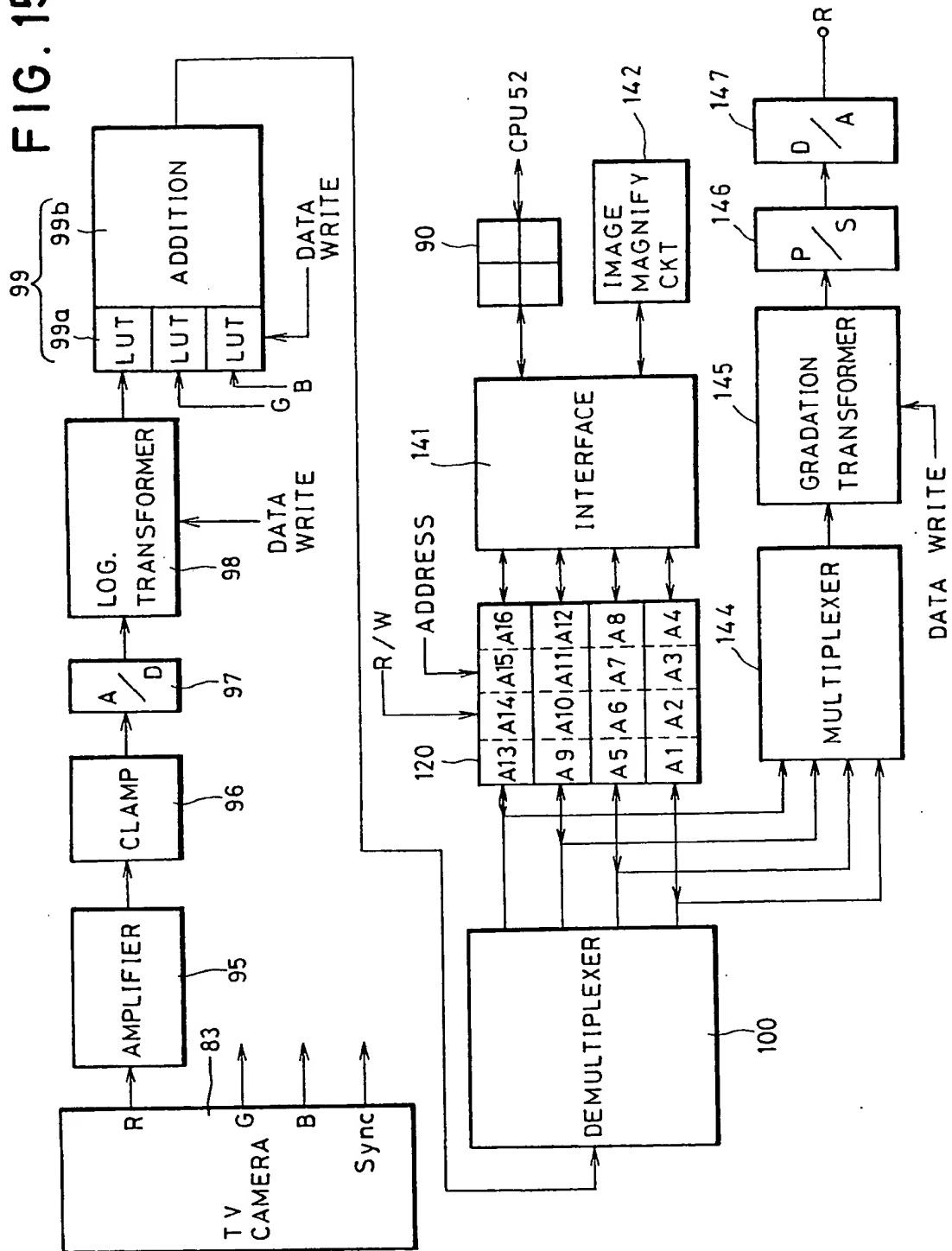


FIG. 15



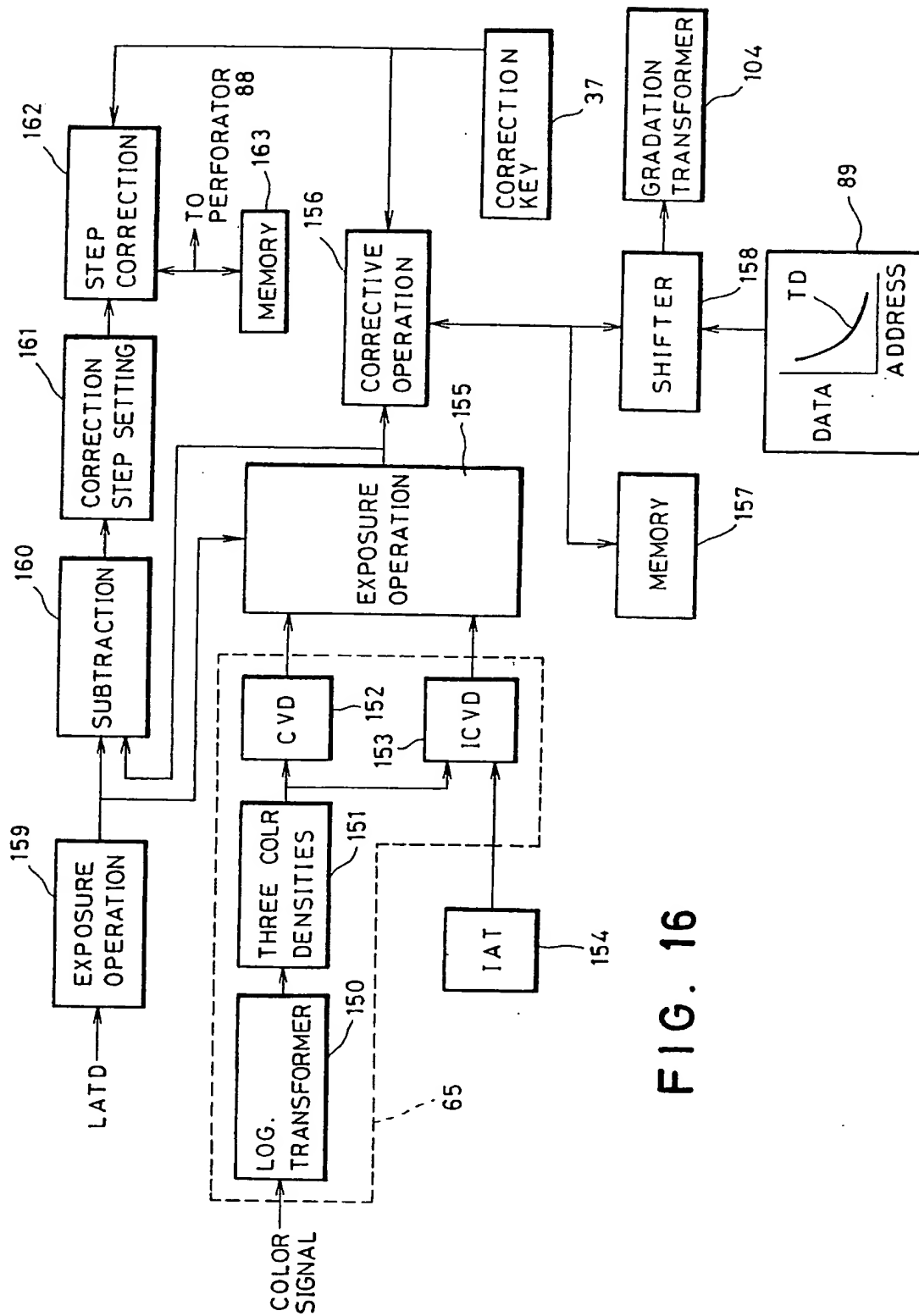


FIG. 16

FIG. 17

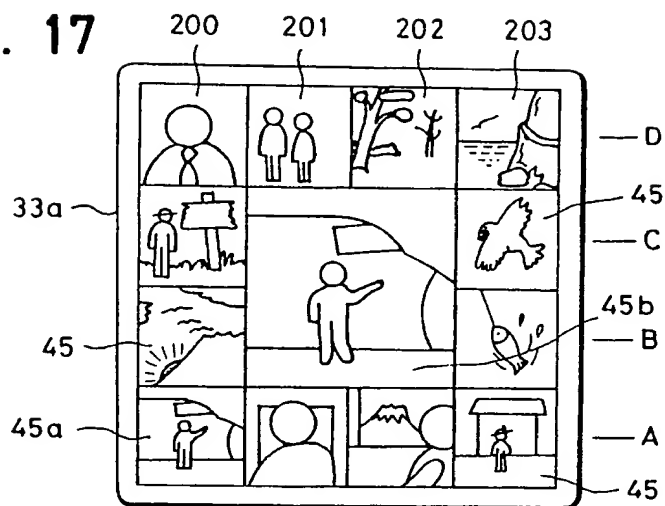


FIG. 18

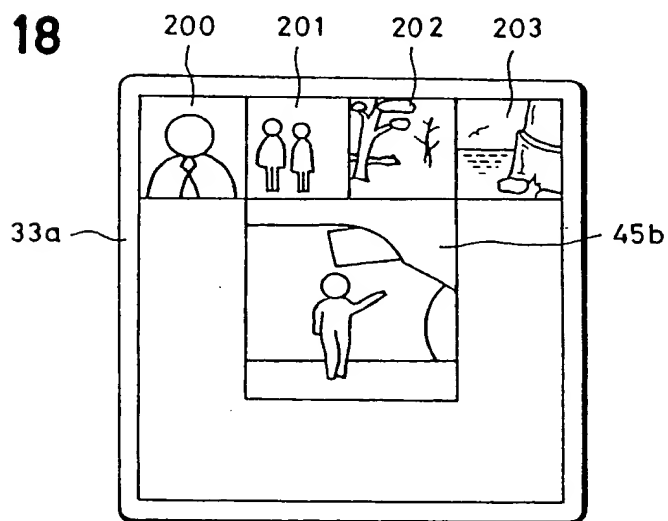
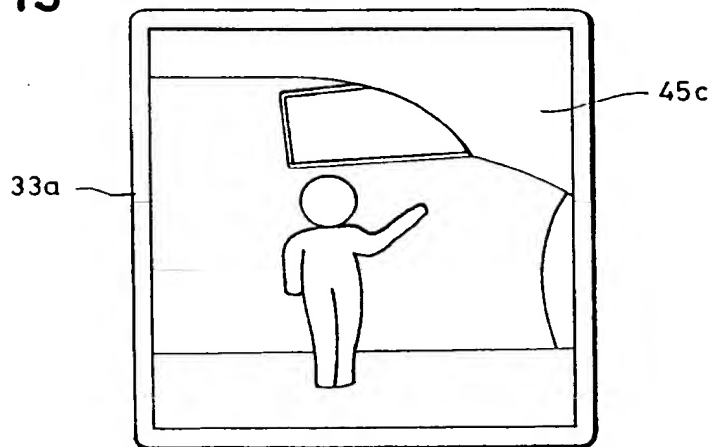


FIG. 19



12

EUROPEAN PATENT APPLICATION

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 04.03.88 JP 51201/88

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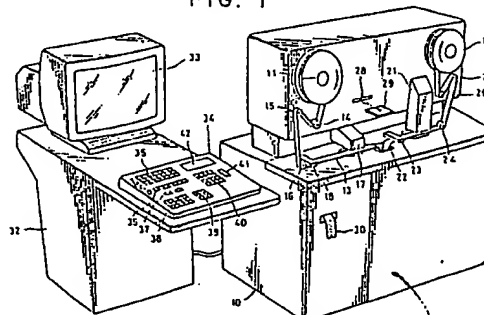
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 Stockmair & Partner
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54 Color film analyzing method and apparatus therefore.

57 A color film analysing method and apparatus which displays the image data as positive images provided by a TV camera and a plurality of reference images previously provided and stored in a recording member, in a matrix pattern on an image display device (33). When specifying one of the color images of the picture frames, the image line of the matrix including the specified image is shifted adjacent to the reference image line on the image display device and a cursor image is displaced overlapping the specified image. The cursor image is provided as a reversed image of the part of the specified image where the specified image is inlaid with the cursor image. If the reversed image has a color identical or similar to that of part of the specified image surrounding the cursor image, the cursor image is colored differently. Any images, when specified, is magnified and displayed at the center of the image display device (33).

FIG. 1





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 89100166.1
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,X	<u>US - A - 4 364 084</u> (AKIMOTO) * Fig. 1,2; column 3, lines 23-26; column 7 *	1,2,6, 28,34	H 04 N 1/46
D,Y	* Fig. 1,2; abstract *	14,29	
D,A	* Fig. 2; column 3, lines 61-63; column 4, line 46 - column 7, lines 38-41 *	3-5,7, 9,13, 20-22, 26,27, 30,35- 39,42	
X	-- <u>GB - A - 2 191 655</u> (FUJI) * Fig. 1-3,6; claims; abstract *	1,28, 34	
A	* Fig. 1-3,6 *	2-5, 13,14, 20-22, 26,35- 39,42	
Y	-- <u>DE - A1 - 2 705 097</u> (AGFA) * Fig. 1,2; page 13 *	14,29	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
Y	-- <u>US - A - 4 279 502</u> (THURM) * Fig. 1,2; column 4, lines 54-59 *	14,29	H 04 N 1/00 G 03 B 27/00 G 03 D 15/00 H 04 N 9/00 H 04 N 17/00
A	* Fig. 1,2 *	1	
A	-- <u>EP - A1 - 0 108 158</u> (KONISHIROKU PHOTO) * Fig. 1-3; abstract *	1,2,7- 10,13- 17,20- 24,27, 28,30, 34-39, 42	
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The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 11-07-1989	Examiner KRAL
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	



European Patent
Office

EUROPEAN SEARCH REPORT

Application number

-2-

EP 89100166.1

DOCUMENTS CONSIDERED TO BE RELEVANT															
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)												
A	<u>EP - A2 - 0 177 857</u> (AGFA) * Fig. 3; abstract; page 3, lines 21-24; pages 9,10 *	1-5,7, 9,13, 14,16, 17,20- 25,34- 37,39- 42													
A	-- <u>US - A - 4 689 669</u> (HOSHINO) * Fig. 1,2,5A-5D; column 6, lines 5-24 *	1-7,9, 13,14, 18,20- 22,28, 30,31, 37,39													
A	-- <u>GB - A - 1 540 525</u> (HELL) * Fig. 6; page 5, lines 62- 71 *	1,7,9, 10,22, 30,31, 39													
A	-- <u>US - A - 4 608 596</u> (WILLIAMS) * Fig. 1,2; column 3, line 62 - column 5, line 14 *	1,14, 21,36, 41													
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.4)												
Place of search VIENNA		Date of completion of the search 11-07-1989	Examiner KRAL												
<table border="0"><tr><td>CATEGORY OF CITED DOCUMENTS</td><td></td></tr><tr><td>X : particularly relevant if taken alone</td><td>T : theory or principle underlying the invention</td></tr><tr><td>Y : particularly relevant if combined with another document of the same category</td><td>E : earlier patent document, but published on, or after the filing date</td></tr><tr><td>A : technological background</td><td>D : document cited in the application</td></tr><tr><td>O : non-written disclosure</td><td>L : document cited for other reasons</td></tr><tr><td>P : intermediate document</td><td>& : member of the same patent family, corresponding document</td></tr></table>				CATEGORY OF CITED DOCUMENTS		X : particularly relevant if taken alone	T : theory or principle underlying the invention	Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date	A : technological background	D : document cited in the application	O : non-written disclosure	L : document cited for other reasons	P : intermediate document	& : member of the same patent family, corresponding document
CATEGORY OF CITED DOCUMENTS															
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Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date														
A : technological background	D : document cited in the application														
O : non-written disclosure	L : document cited for other reasons														
P : intermediate document	& : member of the same patent family, corresponding document														